

DISCUSSION PAPER SERIES

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ABSTRACT

Does the Child Penalty Strike Twice, and If So Why?*

This paper compares the labor market impact of grandparents before and after the arrival of the first grandchild. We show that grandmothers' labor market outcomes decline more steeply than grandfathers' after the first grandchild's arrival, leading to a 4–10 percent gender earnings gap 5–10 years later. The child penalty is shifted across generations to grandmothers with low education, but daycare availability only affects child penalties. Gender biases towards older women's work are a contributing factor to the disparity in earnings between grandmothers and grandfathers after the arrival of the first grandchild.

JEL Classification: J13, J14, J16, J22

Keywords: grandchildren, female labor supply, gender, inequality, retirement

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1 Introduction

Despite narrowing gender gaps in education and labor force participation, convergence in the earnings gap between men and women remains stalled (Goldin, 2014). The arrival of children into a family emerges as a crucial factor in explaining the persistence of gender gaps (Adda et al., 2017; Angelov et al., 2016; Blau and Kahn, 2017; Browning, 1992; Goldin, 2014). Recent research consistently finds that women experience a significant and persistent drop in earnings after giving birth to their first child (Kleven et al., 2019a,b; Sieppi and Pehkonen, 2019). Although the motherhood penalty is reduced as the children grow up, the gender gap in earnings remains substantial as parents reach middle-age (Goldin et al., 2022). Here we investigate whether and if so why the arrival of the first grandchild can explain the persistence of gender gaps in labor market outcomes over the life cycle.

To examine how gender inequality in labor market outcomes is affected by the arrival of a first grandchild, we take a quasi-experimental approach using multi-generational high-quality Danish register data containing annual information for the period 1980–2017 on the full population of families in which an individual became a grandparent for the first time between 1985 and 2012. We adopt an event study approach to study the “grandchild penalty”¹ on earnings, wage rates, labor force participation, full time employment, hours of work, and annual pension savings upon the arrival of a first grandchild.

We find that, while before a first grandchild arrives the pre-trends in labor market outcomes of grandfathers and grandmothers move in parallel, labor market outcomes start to diverge thereafter. Grandmothers’ earnings drop, while grandfathers’ earnings remain largely unaffected, leading to an earnings gender gap of 3.8 percent five years after the event and 10 percent after 10 years. We also document a substantial grandchild penalty in annual pension savings of 1.4 percent. We fail to find any drop in wage rates upon the arrival of a grandchild. Instead the documented financial penalties are driven by labor supply changes at both the

¹Following Kleven et al. (2019b) we use the term “grandchild penalty” to refer to the difference in labor market outcomes between grandmothers and grandfathers upon the arrival of the first grandchild.

intensive and extensive margins. We find grandchild penalties in labor force participation of 1.8 percent and in hours of work of 2.7 percent. We also uncover a grandchild penalty in full time employment of 4.2 percent. The grandchild penalties documented here are economically significant, at about half the size of those incurred by mothers upon the arrival of a child (Kleven et al., 2019b).²

We provide suggestive evidence that the grandchild penalty can be traced back to deeply rooted social norms surrounding gender roles in the family and in the workplace (Bertrand, 2011; Kleven et al., 2019b). While Kleven et al. (2019b) show remarkable similar views across countries on maternal labor force participation among mothers with preschool children, we uncover a clear age-gradient in male respondents view on this matter using data from the European Value Survey. Additionally, a majority of respondents agree with the statements that women should retire or lessen their work commitment earlier than men, supporting the evidence showing that women align their retirement with their typically older male partners, prioritizing shared leisure time (Browning et al., 2021; Bingley and Lanot, 2007; Garcia-Miralles and Leganza, 2021; Stancanelli and Soest, 2012).

In line with economic theory, our findings suggest that a larger child penalty is driven by a lower (relative) opportunity cost and increased demand for child care time on the part of grandmothers. We document that grandmothers from earlier cohorts face a financial impact after a grandchild is born twice as large as those from younger cohorts. These are the grandmothers who had access to more favorable early retirement programs themselves. We identify a shift of the child penalty across generations from mother to grandmother when the grandmother’s opportunity cost, as indicated by educational level, is less than that of

²Our results are comparable to those in the literature investigating how older workers adjust their labor market outcomes in response to a grandchild. We find a 17.5 percent drop in grandmothers’ earnings and 13.5 percent in labor force participation at event time 10, consistent with Frimmel et al. (2020) who estimate increased probability hazards of leaving the labor market of 8–11 percent. Karademir et al. (2023) find that the event of a grandchild reduces grandmothers’ labor force participation by 8 percent and their earnings by 16 percent. Papers using the gender of the firstborn child to instrument for the timing of grandparenthood generally find large effects on labor force participation in the range 33–36 percent (Rupert and Zanella, 2018; Backhaus and Barslund, 2021). These effect sizes are local average treatment effects and thus not directly comparable to our results.

her daughter. We also observe that earnings decline more significantly for maternal grandmothers compared to paternal grandmothers. This finding is consistent with grandmothers' time being in higher demand when her first grandchild is born to her daughter rather than her son, likely because of intergenerational ties being stronger on the mother's side of the family than the father's (Brunello and Yamamura, 2023; Chan and Elder, 2000). Finally, we also document that grandmothers residing closer to their grandchildren experience a larger grandchild penalty (4.5 percent vs. 3.2 percent), probably because they face greater demand on their time.

Our findings additionally point to another mechanism behind the grandchild penalty related to the role of grandmothers as complements to the public provision of child care. The Danish public daycare has set schedules and do not offer the flexibility needed to accommodate children's unpredictable needs, such as sudden illness (Datta Gupta and Simonsen, 2010). Our analysis of Danish time-use surveys from 1987, 2001, and 2008 indicates that not many grandparents engage in child care, that the time spent on child care is relatively small for those who do any child care, and that child care provision is often concentrated in the afternoons.³ We also uncover that whereas the child penalty in earnings is smaller in places with higher daycare enrollment, there is no correlation between the grandchild penalty in earnings and the daycare enrollment rate. All in all our findings suggest that the grandchild penalty may arise from the need for grandmothers to remain 'on-call' ready to help with unexpected child care needs, rather than from the actual time demands for child care.

Our paper contributes to a large body of literature documenting persistent gender gaps in the labor market over the life cycle (Adda et al., 2017; Goldin, 2014, 2021; Angelov et al., 2016; Kleven et al., 2019b,a, 2023). A recent line of work study the effect of children on labor market outcomes for grandparents (Asquith, 2017; Backhaus and Barslund, 2021; Frimmel et al., 2020; Karademir et al., 2023; Rupert and Zanella, 2018; Wang and Marcotte, 2007;

³11 percent of the grandparents report spending time in child care activities. These numbers align with numbers from the American Time Use Surveys (ATUS) where 16 percent of women and 11 percent of men aged 50–64 report spending time in primary child care (Rupert and Zanella, 2018).

Zanasi et al., 2020). Because of data limitations most of the previous literature focuses on labor market participation and hours work.⁴ Except for a recent study that uses tax records with information on earnings and employment (Karademir et al., 2023), our understanding of the impact of the financial implications after the arrival of grandchildren has remained elusive so far. Yet, answering this question is of utmost importance given that financial reliance on younger generations is dwindling and public pensions are strained by demographic shifts. The detailed financial information in the Danish administrative data over long periods of time and a wide set of economic outcomes—including earnings, participation, hours and pension savings—helps us paint a complete picture of the life cycle financial implications of the grandchild penalty.

We also contribute to our understanding of labor market gender inequalities by uncovering an until now overlooked mechanism behind the child penalty. Most studies of grandparents' labor outcomes rely on a model that assumes substitutability between time with mothers, time with grandmothers' and time in formal daycare centers (Backhaus and Barslund, 2021; Frimmel et al., 2020). Our ability to draw from time use data, as well as to link the multi-generational administrative data with spatial data on daycare enrollment, allow us to uncover that the timing of grandmothers' provision of child care, rather than the amount of time, seem to be driving our results. Along the same lines as Goldin (2014); Goldin and Katz (2016); Goldin et al. (2022) argue that the labor market's demand for workers being 'on-call' is a driver of persistent gender gaps in the labor market, our study highlights the lack of substitution between care givers and the need to be 'on-call' at home as a key mechanism driving child penalties. Recognizing this channel is important for the design of policies attempting to reduce child penalties for mothers and grandmothers.

⁴Rupert and Zanella (2018) use data from the Panel Study of Income Dynamics (PSID) on employed men and women aged 35–75 and Backhaus and Barslund (2021) use data from the Survey of Health, Ageing and Retirement in Europe (SHARE) on men and women aged 55–64 to look at labor force participation and hours of work. Wang and Marcotte (2007) also use PSID data but focus on the labor force participation and hours worked by grandparents living in the same household as their grandchildren. Zanasi et al. (2020) use data from the English Longitudinal Study of Ageing (ELSA) on women aged 50–65 to study the relation between grandparenthood and retirement. A recent study uses Austrian administrative data to look at the increased probability of retirement upon grandparenthood for women aged 50–60 (Frimmel et al., 2020).

The paper is organized as follows. Section 2 presents the data we use in our analysis. Section 3 outlines our empirical event study approach, and Section 4 presents the results. Section 5 concludes.

2 Data

We construct a multi-generational data set by linking individuals across three generations of children, parents, and grandparents. Danish register data combine several administrative registers, which are linked via personal identification numbers. The breadth of the register data allow us to combine data on a range of socioeconomic characteristics such as employment histories, labor market earnings, pension savings, education and, e.g., to distinguish between grandparents on the mother’s and the father’s side of the family.⁵

Our main sample includes 1,193,748 grandparents who become grandparents for the first time over the 1985–2012 period to a total of 556,503 grandchildren. The event studied is the birth of an individual’s first grandchild. For each event, we observe calendar year and grandparent’s age, and socio-economic characteristics of the grandparent, an eventual partner, and the parents of the grandchild. We restrict the sample to individuals who become grandparents to their first grandchild between the ages of 35 and 80 and for whom we observe a balanced panel of individuals that are alive five years before and five years after the first grandchild is born.⁶ Table 1 shows summary statistics for our sample of grandparents. The grandmothers were about 2.5 years younger than the grandfathers in our sample when they had their first child. Similarly, the grandmothers are younger than the grandfathers when they have their first grandchild.

We utilize the longitudinal nature of the registers to examine the long-run impact of grandchildren, measured ten years after the arrival of the first grandchild. In the long-run analysis, we allow for gradual attrition of individuals in our sample between six and ten

⁵Data are accessible in anonymized form for researchers based in Danish research institutions through secured access to Statistics Denmark.

⁶Appendix Figure A1 panel (a) shows a histogram of age a first grandchild’s birth.

Table 1: Background Characteristics for Grandfathers and Grandmothers

	(1) All	(2) Grandfather	(3) Grandmother	(4) Difference
Age at first child's birth	25.58 (4.840)	26.96 (4.834)	24.39 (4.518)	2.566*** (299.55)
Age at first grandchild's birth	54.53 (6.918)	55.80 (6.817)	53.43 (6.816)	2.370*** (189.45)
Year of birth	1943.7 (10.01)	1942.5 (9.997)	1944.8 (9.901)	-2.282*** (-125.03)
Single-headed household	0.182 (0.386)	0.146 (0.353)	0.214 (0.410)	-0.0678*** (-96.13)
Maternal grandparent	0.538 (0.499)	0.540 (0.498)	0.537 (0.499)	0.00310*** (3.39)
High daycare enrollment	0.425 (0.494)	0.423 (0.494)	0.426 (0.495)	-0.00259*** (-2.85)
Commute time > 20 min	0.609 (0.488)	0.622 (0.485)	0.597 (0.490)	0.0249*** (27.83)
Observations	1,193,748	554,870	638,878	1,193,748

Note— The table shows means and standard deviations of the background characteristics of the sample in column (1) and separately for grandfathers and grandmothers in columns (2)–(3). Column (4) plots t-statistics of the difference between grandfathers and grandmothers.

years following the birth of the first grandchild, which may be attributed to mortality or emigration. Ten years after the birth of the first grandchild, 78 percent of the individuals in our main sample remains included in the analysis.

We analyze the effects of grandparenthood using six labor market outcomes: (a) Annual labor earnings;⁷ (b) Labor force participation (a dummy taking the value one for individuals with positive earnings and zero otherwise); (c) Work hours, allowing us to capture labor

⁷Measured before tax and excluding any unemployment insurance benefits or other public transfers. Earnings are reported directly from employers to the tax authorities, so bias/measurement error stemming from self-reporting is not an issue. See Appendix Figure A1 panel (b) for an age profile of earnings.

adjustments on the intensive margin;⁸ (d) Dummy for full time work;⁹ (e) Hourly wage rates;¹⁰ (f) Annual pension savings for a sub-sample of individuals who become grandparents between 2000–12.¹¹ All monetary variables are inflated to reflect 2018-prices and annual incomes top coded at one million DKK, while annual pension savings are top coded at 200,000 DKK.

Figure 1 plots the averages of all outcomes five years before through five years after the arrival of the first grandchild. On average, grandfathers have higher earnings than grandmothers, but grandfathers’ earnings drop more than those of grandmothers, reflecting that grandfathers are older than grandmothers when having their first grandchild and thus closer to retirement (panel a). Our event study controls non-parametrically for these life-cycle patterns by including individual and age fixed effects. Hours of work and full time employment evolve similarly (panels c and d); the levels are initially higher for grandfathers than for grandmothers, but drop at a faster rate across the event time window. In contrast, we see similar levels of labor force participation of grandmothers and grandfathers across the event time window (panel b). The wage rates increase slightly across the event time window at a similar rate for grandmothers and grandfathers (panel e). Annual pension savings increase before the arrival of the first grandchild and drop hereafter (panel f).

In order to investigate heterogeneity across our sample of individuals who become grandparents between 1985 and 2012, we exploit register information on cohabitation/marital

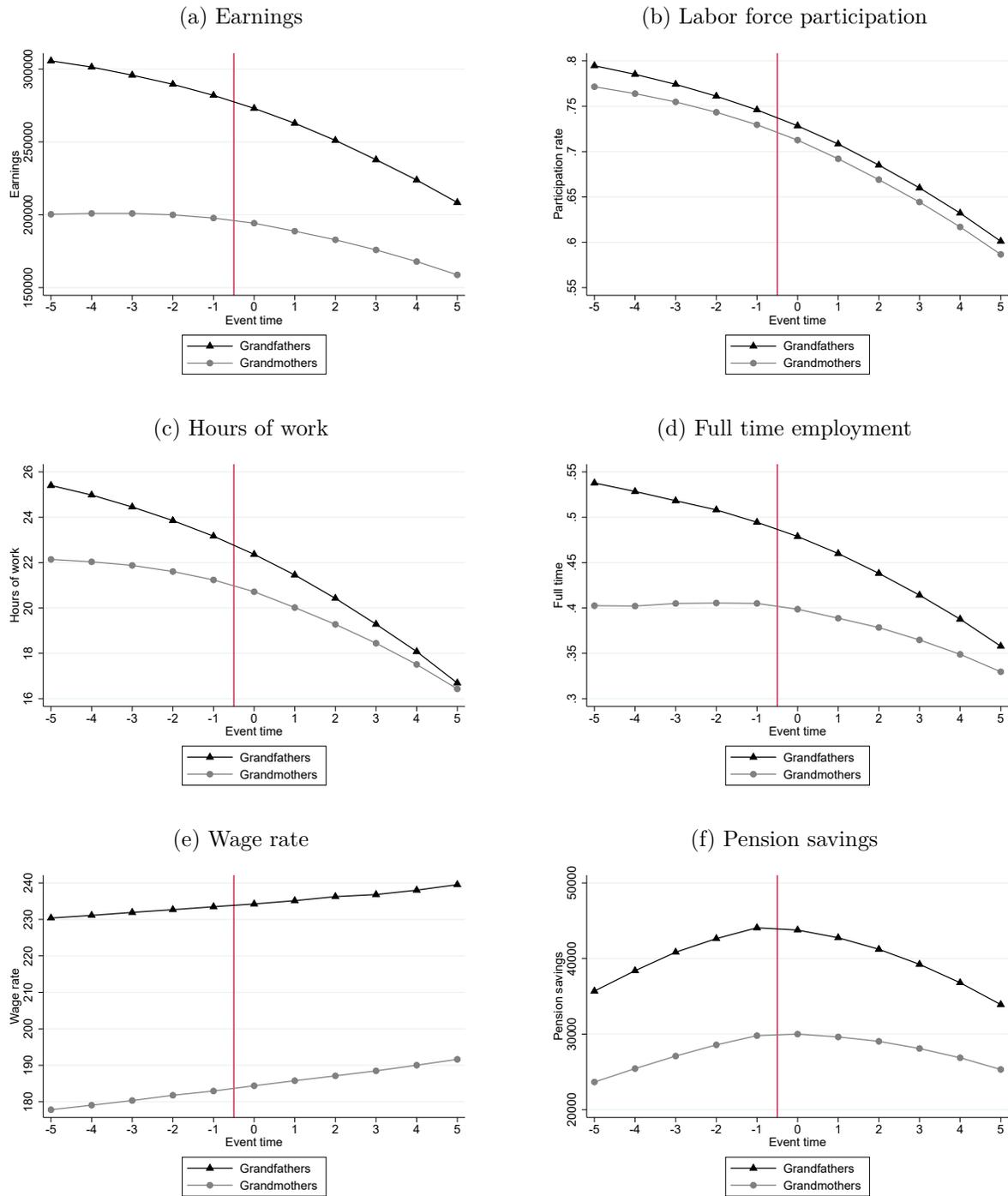
⁸This measure, which is recorded in bins, is based on information from employer contributions to a mandatory pension scheme, ATP. The ATP scheme (*“Arbejdsmarkedets Tillægspension”*) requires all employers to make contributions for each employee based on their individual work hours, aggregated in bins (0–8, 9–17, 18–26, 27+, if paid per week, or 0–38, 39–77, 78–116, 117+, if paid monthly). Unfortunately, we are not able to distinguish between people who work part time throughout the year and people who, e.g., work full time half the year and quit working the rest of the year. Based on this information, we construct a measure of weekly hours of work averaged across the year.

⁹We construct a full time dummy taking the value one if the grandparent works full time the entire year and zero otherwise (including if the grandparent retires, works part time, or has never worked). This variable captures people who switch from working more than 27 hours per week (or more than 177 per month) through out the year to working less.

¹⁰Hourly wage rates are calculated from annual earnings divided by 52 weeks times our measure of weekly hours of work. As work hours are capped at the top, these may be underestimated, and the imputed hourly wage rate may thus be overestimated for full-time employed working more hours than the top cap.

¹¹The register on pension savings starts in 1995. The register contains information on employer-based and private contributions. See Appendix Figure A1 panel (c) for an age profile of pension savings.

Figure 1: Mean of Outcome Variables



NOTE— The figure shows means of the outcome variables across event time separately for grandmothers and grandfathers.

status, and municipality of residence for both the grandchild and the grandparents, which we combine with data on travel time and distance between municipalities to investigate if

proximity between grandparents and grandchildren plays a role. In addition, we utilize information on the average enrollment rate in formal daycare for all municipalities in the period 1985–2012. We use this data to construct an annual indicator variable taking the value one for municipalities with above-mean enrollment rates, and we link these to the individuals in our sample by municipality of residence of the first grandchild in its birth year.

3 Empirical Strategy

To gauge the effect of having a grandchild on grandparents’ labor supply, we implement an event study approach that relies on sharp changes around the birth of the first grandchild for grandmothers relative to grandfathers. As in similar event studies (Kleven et al., 2019b), the idea is that although becoming a grandparent *per se* is not exogenous, the event of having a grandchild may generate sharp changes in labor market outcomes that are orthogonal to unobserved factors that affect the smooth development of those outcomes. We estimate the following regression separately for grandmothers and grandfathers:

$$Y_{ist}^{gp} = \sum_{j \neq -1, -2} \alpha_j^{gp} \cdot \mathbb{1}[j = t] + \sum_k \beta_k^{gp} \cdot \mathbb{1}[k = age_{is}] + \sum_\lambda \gamma_\lambda^{gp} \cdot \mathbb{1}[\lambda = s] + v_i^{gp} + \mu_{ist}^{gp} \quad (1)$$

where Y_{ist}^{gp} is the labor market outcome of interest for individual i in year s at event time t . The superscript gp refers flexibly to the type of grandparent (e.g., grandmothers and grandfathers or, more specifically, maternal and paternal grandmothers and grandfathers, respectively). We include a full set of age and year dummies. Age dummies control non-parametrically for underlying life-cycle trends, which is important as women on average become grandmothers two years earlier than men become grandfathers. Moreover, age dummies take account of age-related rules for e.g. retirement eligibility. Year dummies take into account in a non-parametrical way any time trends resulting for example from business cycle effects or changes in pension legislation or parental leave schemes. As grandparenthood occurs at an age when labor force participation starts descending, controlling for age and

year dummies alone is not necessarily enough to ensure a flat pre-trend. We therefore also include an individual fixed effect, v_i^{gp} . We omit the event times $t = -5$ and $t = -1$ so that the estimated event time coefficients α_j^{gp} refer to the trend between the years before the first grandchild is born.

The underlying assumption behind identification of causal effects in an event study model as Equation (1) is that while changes in individual, family, and work preferences evolve gradually over an individual’s life course, the birth of a grandchild is a more sudden event. As a result, any sharp change in labor market outcomes right around the birth of a first grandchild is likely to be the result of the arrival of the grandchild at that particular point in time, rather than being due to a change in family and labor market preferences. This so-called smoothness assumption is common to all event studies and is likely to hold in our analysis because it focuses on short run effects five years after the birth of a grandchild. An additional advantage of the event study is that it describes the dynamic adjustment to a new situation of being a grandparent.

Following Kleven et al. (2019b), we specify the equation in levels rather than logs to keep those with zero earnings in the data, and we convert the estimated effects in levels to percentages by scaling the estimates with the counterfactual outcome absent grandchildren. Thus, the percentage change in outcomes of each grandparent is given by $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$, where \tilde{Y}_{ist}^{gp} is the predicted outcome when the event time dummies are omitted from Equation (1). We construct the “grandchild penalty” as the percentage by which grandmothers fall behind relative to grandfathers due to the arrival of a grandchild at event time t as:

$$P_t \equiv \frac{\hat{\alpha}_t^{gf}}{\mathbb{E}[\tilde{Y}_{ist}^{gf} | t]} - \frac{\hat{\alpha}_t^{gm}}{\mathbb{E}[\tilde{Y}_{ist}^{gm} | t]} \quad (2)$$

The grandchild penalty is thus defined as the gender gap in labor market outcomes associated with having a grandchild. We also estimate long-run grandchild penalties by extending the period to ten years after the birth of the first grandchild. The ten-year follow-up is based on our main sample of individuals observed five years before and five years after the birth of

their first grandchild.

For a sub-sample of our data set we explore how a reform of early retirement routes affects the dynamic effects of grandparents labor market outcomes around the birth of the first grandchild. To disentangle the causal effect of giving grandparents the option to retire at age 50 instead of at age 60, we estimate Equation (3) separately for grandmothers and grandfathers:

$$\begin{aligned}
 Y_{ist}^{gp} = & \sum_{j \neq -1, -2} \alpha_j^{gp} \cdot \mathbb{1}[j = t] + \sum_{j \neq -1, -2} \delta_j^{gp} \cdot \mathbb{1}[j = t] \cdot TREAT + \\
 & \sum_k \beta_k^{gp} \cdot \mathbb{1}[k = age_{is}] + \sum_\lambda \gamma_\lambda^{gp} \cdot \mathbb{1}[\lambda = s] + v_i^{gp} + \mu_{ist}^{gp}
 \end{aligned} \tag{3}$$

where $TREAT$ is a dummy taking the value 1 for individuals born 1942–1946 and 0 for individuals born 1947–1951. $\alpha_j^{gp} + \delta_j^{gp}$ captures the dynamic labor market effects around the birth of the first grandchild for grandparents who had the option to retire at age 50, while α_j^{gp} captures the dynamic effects for grandparents who at the earliest could retire at age 60.

Furthermore, as an identification check, we study the effects of having grandchildren *per se* in a Difference-in-Differences (DiD) event study where men and women who do not (yet) have grandchildren function as control groups.

4 Results

This section reports the results from our event study. We estimate Equation (1) separately for grandmothers and grandfathers. Figure 2 shows the percentage changes of our six labor market outcomes at a given event time t relative to the year before the first grandchild is born. Panel (a) in Figure 2 shows a large drop in earnings after the first grandchild is born, particularly for grandmothers. While earnings of grandmothers and grandfathers evolve in parallel before the arrival of the first grandchild, they start diverging shortly after the first grandchild is born. In particular, whereas earnings of grandfathers do not change much in the first years after the birth of their first grandchild, grandmothers experience an earnings

drop of 1.6 percent the first year, and their earnings continue to decline at a much steeper rate than the earnings of grandfathers. Five years after the arrival of the first grandchild, the earnings of grandmothers have dropped 6.0 percent, while the earnings of grandfathers have only dropped by 2.2 percent. As a result, the grandchild penalty as defined in Equation (2) amounts to 3.8 percent five years after the arrival of the first grandchild.

To understand the source of the widening earnings gap and the implications hereof, panels (b)–(f) of Figure 2 document the changes in other labor market outcomes. Each of the six labor market outcomes in panels (a)–(f) show parallel pre-trend trajectories prior to the arrival of the first grandchild, but only earnings, labor supply outcomes (at the extensive and intensive margin), and pension savings exhibit changes shortly after the first grandchild is born. In particular, the relative decline in grandmothers earnings is primarily driven by declining hours of work, full time employment, and labor force participation. Panel (c) shows that while both grandparents experience declining work hours after the birth of the first grandchild, the drop in grandmothers’ work hours is steeper and more persistent than grandfathers’ hours. Five years after the arrival of the first grandchild, the grandchild penalty in hours worked amounts to 2.7 percent. Similarly, the results in panel (d) show that whereas grandfathers experience almost no change in full time employment over the five year period after the arrival of the first grandchild, there is a sharp and continuing fall in full time employment for grandmothers, implying that grandmothers are 4.2 percent less likely to work full time than grandfathers. This suggests that grandfathers do not experience the same challenge of balancing child care and market work as grandmothers. We find no adjustments in the wage rate; panel (e) shows a constant wage rate both pre- and post-event for both grandmothers and grandfathers. Finally, panel (f) shows that while annual pension savings drop for both grandmothers and grandfathers, grandmothers respond more strongly than grandfathers and thus experience a grandchild penalty in pension savings of 1.4 percent, implying that grandmothers’ financial loss upon grandparenthood reaches well into their retirement. In the longer-run, i.e., ten years after the arrival of the first grandchild, the

gender gaps expand and often more than double compared to the five-year gap, as evidenced in Appendix Figure A2.¹² The earnings gap, for example, increases from 3.8 percent after five years to 10.1 percent after ten years.¹³

As a robustness check, panels (a) to (f) of Appendix Figure A3 reports grandparent penalty estimates using a DiD event study model, which can be interpreted as the percentage by which grandmothers (grandfathers) fall behind women (men) without grandchildren. The DiD event study thus compares women to women and men to men, as opposed to our gender gap estimates comparing women to men. The results are qualitatively the same.

Overall, our results are close to the lower range of estimates reported in the literature on labor supply adjustments following the birth of a grandchild. Backhaus and Barslund (2021) find reductions in grandmothers' labor supply of 30 percent using cross-country data from SHARE. Using PSID data for the U.S, Rupert and Zanella (2018) show reductions in hours of work as high as 36 percent. Also using PSID data, Wang and Marcotte (2007) find that grandparents increase their labor supply when they live in the same household as their grandchildren. Hinting, that the arrival of a grandchild has differential effects on a grandparent's labor market outcomes depending on the social context.¹⁴ While Backhaus and Barslund (2021) and Rupert and Zanella (2018) identify local average treatment effects, our identification strategy yields estimates that are more directly comparable with those reported in Frimmel et al. (2020) and Karademir et al. (2023). Frimmel et al. (2020) find that grandmothers' probability of leaving the labor market increases by 8.5 percentage points, which are in line with our results on labor force participation. Moreover, the magnitude of our

¹²Given that our sample of grandparents are older and nearing retirement, following up on labor supply effects beyond ten years after becoming a grandparent runs into precision problems due to retirement and attrition due to mortality.

¹³Specifically, while grandmothers earn 17.5 percent less ten years later compared to the year before the arrival of the first grandchild, grandfathers' earnings only fall by 7.5 percent. For both grandmothers and grandfathers, labor force participation decreases gradually after the birth of the first grandchild such that ten years after the birth of the first grandchild, participation is 13.5 and 9 percent lower for grandmothers and grandfathers, respectively.

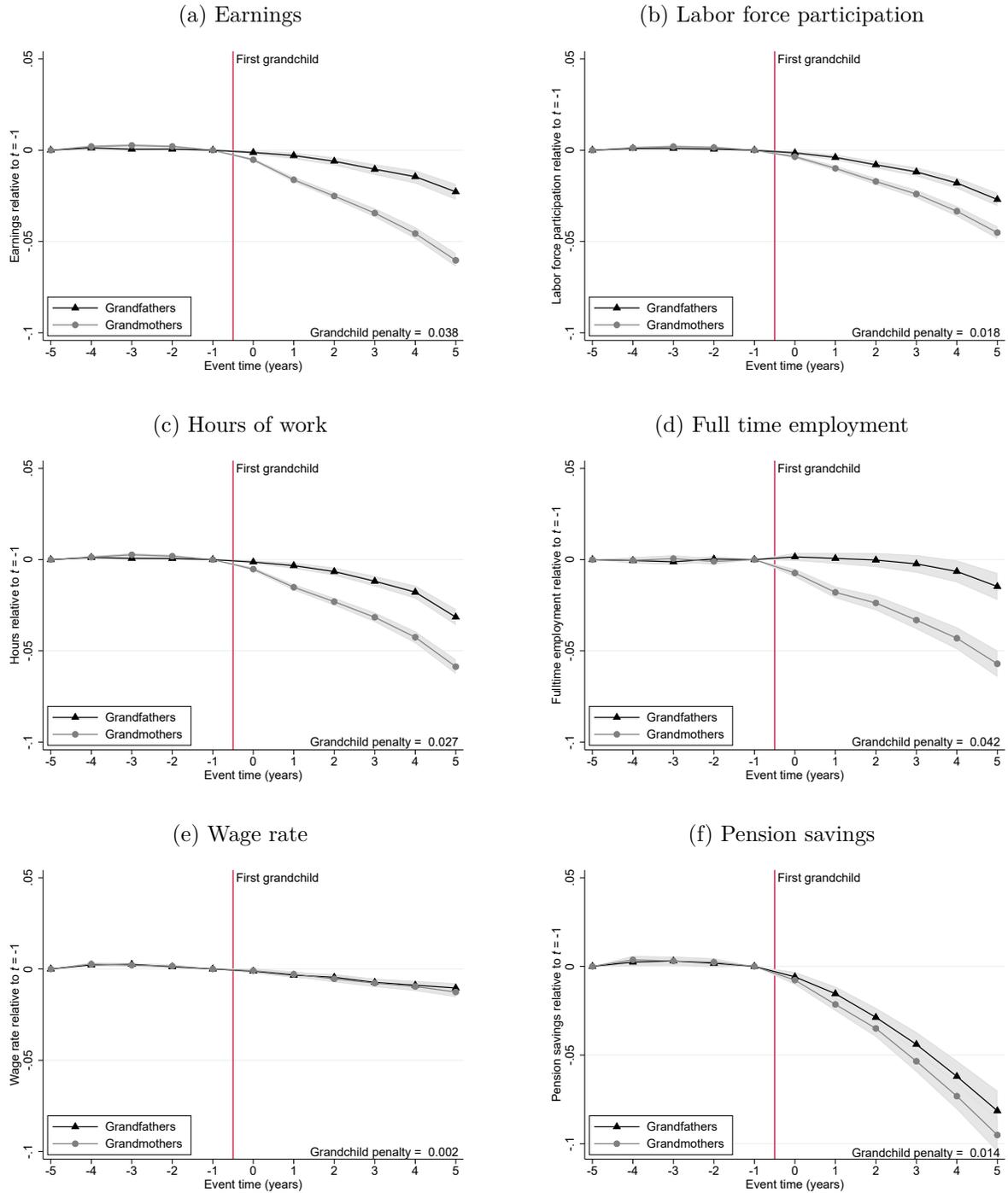
¹⁴Using a longitudinal survey from China, Meng et al. (2023) find only temporary effects on mothers' labor force participation, while grandmothers' labor force participation drop by 18 percentage points immediately after the arrival of the first grandchild and continues hereafter at this level.

results are in line with the results by Karademir et al. (2023), who find that grandmothers' (grandfathers') earnings dropped by 16 (15) percent ten years after the arrival of the first grandchild.¹⁵

The grandchild penalties documented here are relatively large compared to the child penalties in Denmark documented in Kleven et al. (2019b). Kleven et al. (2019b) find a child penalty in parental earnings of around 20 percent on average, whereas we find a grandchild penalty of 3.8 percent five years after the first grandchild. This figure corresponds to about one fifth of the child penalty incurred by parents. The mechanisms driving the child penalties for parents and grandparents are also different. While grandchild penalties on hours worked and participation rates are both substantial, there is no grandchild penalty on wage rates, indicating that grandparents do not adjust by selecting into other occupations, sectors or firms sacrificing wage premium for flexibility at this point in their career.

¹⁵For employment, they find drops of 8 percent and 6 percent for grandmothers and grandfathers, respectively. While these results are similar to our results, it is noteworthy that their results hardly differ by gender.

Figure 2: The Impact of Grandchildren



NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers fall behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. The wage effects are estimated conditional on participation. The pension savings effects are based on a sample of families in which the first grandchild is born 2000–12. The shaded 95 percent confidence intervals are based on bootstrapped standard errors.

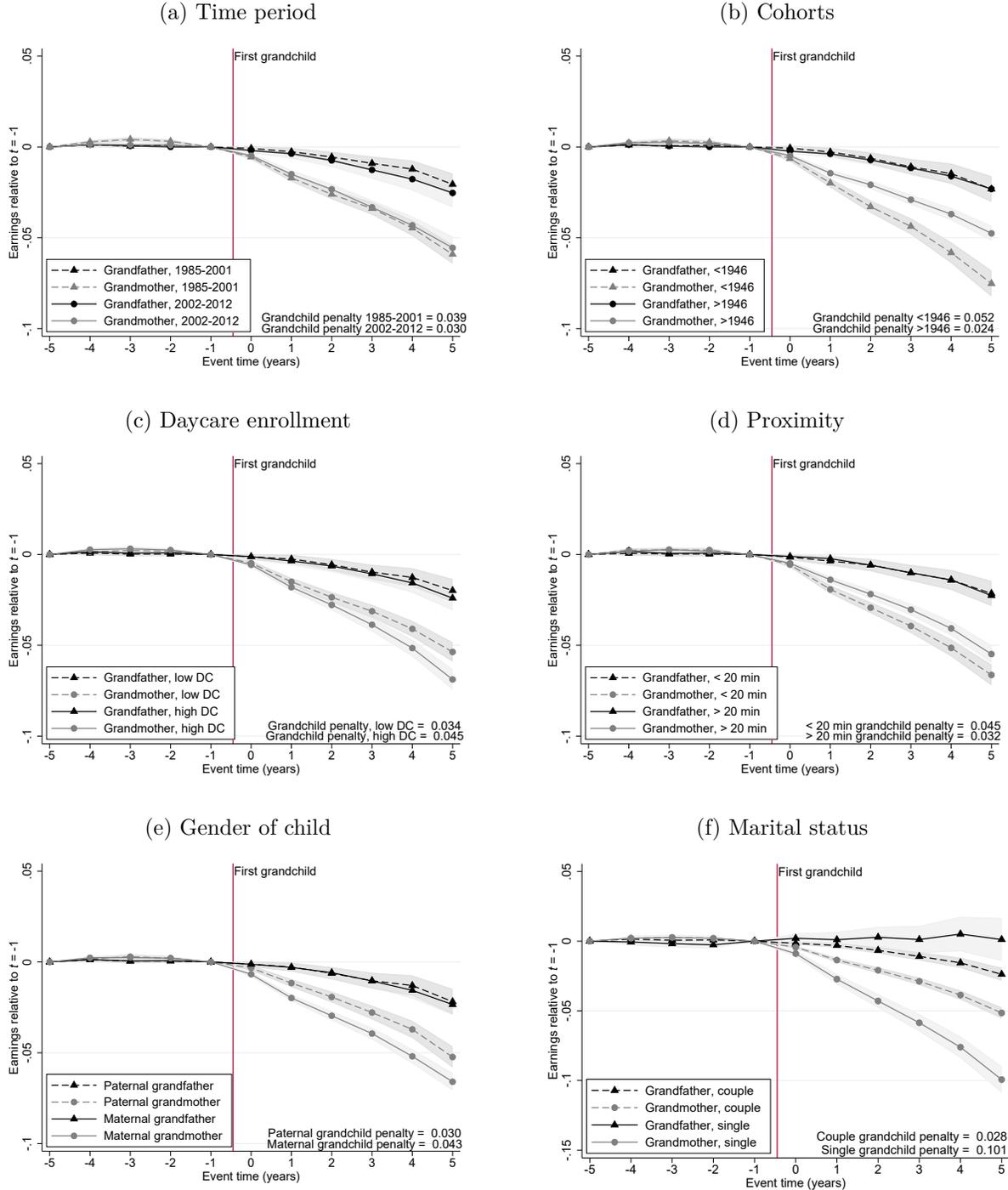
4.1 Grandparents providing flexibility for their offspring

The economics literature on gender gaps over the life cycle has identified an important role for job amenities, and in particular employer demands for high employee flexibility in certain professions (Goldin, 2014; Goldin et al., 2022; Blau and Kahn, 2017).¹⁶ While we find no change in wage rates upon the arrival of the first grandchild, the drops we observe in grandparents' earnings and labor supply may arise because they provide some flexibility to young parents for them to reconcile family and career.

The degree to which such flexibility is needed and provided varies across time periods, household types, and institutional and social contexts for parents and grandparents. Figure 3, panels (a)–(f), shows the heterogeneity in the event study coefficients for earnings along six dimensions: (a) time period (before/after 2002-extension of parental leave), (b) cohorts of grandparents born before and after pension reform, (c) daycare enrollment rate in the municipality where the grandchild lives, (d) proximity between grandchild and grandparents in terms of travel time, (e) gender of the parent of the grandchild, and (f) cohabitation/marital status of grandparents. Figures A4–A9 in the appendix show the heterogeneous effects for all labor market outcomes.

¹⁶These so-called “greedy” professions pay disproportionately more for long hours and weekend work, which are difficult to reconcile with family life. Consequently, gender pay gaps emerge because of differences in male and female preferences for greedy and flexible employment (Goldin, 2021). In the Danish setting, Kleven et al. (2019b) show that one-third of the child penalty stems from reductions in wage rates because mothers move to sectors with more flexibility but lower wages.

Figure 3: Heterogeneity in the Impact of Grandchildren



NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately for earnings. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Differences across time periods. In panel (a) of Figure 3 we subdivide our sample into two main time periods, 1985–2001 and 2002–2012, respectively. Policy-wise, these two periods differ with respect to three important policy dimensions: 1) The length of parental leave periods, 2) access to early retirement, and 3) access to formal daycare. First, while parents of children born in the sub-period 1985–2001 were entitled to 26 weeks of parental leave after the birth of a child, parents of the children born 2002–2012 were entitled to 52 weeks of leave. Second, while the first period was characterized by a relatively low retirement age and relatively low labor force participation of older women, retirement reforms in the late 1990’s reduced access to early retirement. Third, availability of formal subsidized daycare—especially for children younger than three—was lower in the earlier period. Despite these policy differences across time periods, panel (a) of Figure 3 shows very small differences in the grandchild penalty across the two periods studied.

Differences across birth cohorts of grandparents. In panel (b) of Figure 3, we explore the significance of pension reforms further by subdividing the sample into two groups of grandmothers and grandfathers who were born in or before 1946 versus after 1946. While individuals born in or before 1946 could leave the labor market at age 50 through early retirement options, cohorts born in 1947 and hereafter had to wait until age 60 before they could retire. Figure 3, panel (b), shows significant differences across these cohorts of grandmothers: while the earlier cohorts of grandmothers experienced an earnings penalty of 5.2 percent, later cohorts of grandmothers experienced an earnings penalty of 2.4 percent. In section 4.2 we examine if the difference in grandchild penalties are caused by the policy change of the pension system.

Differences by daycare enrollment. We next explore how variation in daycare access across municipalities is related to grandchild penalties.¹⁷ Daycare availability may impact grandparental involvement in the care for grandchildren in two directions. On the one hand,

¹⁷During the 1960s and 70s female employment and daycare enrollment increased simultaneously. Today, the majority of Danish children enroll in center-based daycare before they start school. However, there exist variations in the take-up across areas.

parents in areas with *low* daycare enrollment may rely on child care provided by grandparents as a *substitute* for formal daycare. On the other hand, parents in areas with *high* daycare enrollment may benefit from grandparental care outside the opening hours of the child care center, suggesting that formal daycare and grandparental care may be *complements*. To investigate this channel, we stratify the sample according to high and low daycare coverage for 0–2 year-old children in the municipality where the firstborn grandchild lived at birth. Panel (c) of Figure 3 shows that grandmothers’ earnings decline relatively more when the grandchild lives in a municipality with high daycare coverage, suggesting that grandmothers’ child care time is complementary rather than a substitute to formal daycare. We examine this question further in section 4.3.

Proximity to grandchildren. Grandparents who live closer to their grandchildren experience a lower opportunity cost (via lower travel time and transportation costs) when going to see their grandchildren and may thus be more inclined to provide child care.¹⁸ In order to examine if grandparents’ proximity affects the grandchild penalty, we stratified the sample according to whether commuting time is more or less than 20 minutes between the municipalities where the grandparents and the firstborn grandchild lived in the first year of the grandchild’s life.¹⁹ Panel (d) of Figure 3 shows that grandmothers who live less than 20 minutes away from their grandchild experience a slightly higher grandchild penalty than grandmothers who live further away, suggesting that grandmothers having lower commuting costs may be more easily available for child care, and/or may have preferences for being close to their family. There is no difference in earnings for grandfathers depending on travel time.

In the Appendix, we explore whether commuting time and distance between grandparents and parents change following the birth of a grandchild (because grandparents move closer

¹⁸Using U.S. Census data and the National Survey of Families and Households, Compton and Pollak (2014) find that residential proximity to grandmothers (a distance less than 25 miles) increases labor force participation of women with children younger than 12 by about 10 percentage points.

¹⁹There are currently 98 municipalities in Denmark. The median municipality has around 43,000 inhabitants. Municipalities range in size from a few very small islands with around 2,000 inhabitants to Copenhagen with more than 600,000 inhabitants in recent years. The average commuting time between parents and grandparents is 54 minutes and 40 percent of our sample lives less than 20 minutes away from each other.

to their children or the children move closer to the grandparents). Using our event time method with the dependent variable being commuting time and commuting distance between grandparents and parents, respectively, we show (in Figure A10) a small reduction in both commuting time and commuting distance between grandparents and children following the birth of a grandchild. This effect is larger if the parent of the firstborn grandchild is a daughter rather than a son, suggesting that maternal grandparents and their daughters move closer to each other after the birth of the first grandchild.²⁰

Gender of the parent - Differences between daughters and sons. We next investigate if the drop in grandparents' earnings depend on whether their first grandchild is the child of their daughter or their son, as previous research have shown that the exchange of time and services across generations is stronger on the mother's side of the family than the father's side (Brunello and Yamamura, 2023). We define a maternal (paternal) grandparent as a grandparent to a grandchild born by the grandparents' daughter (son). Panel (e) of Figure 3 shows that the maternal grandchild penalty in earnings is larger than the paternal grandchild penalty.²¹ This evidence confirms past findings; Frimmel et al. (2020), e.g., find that labor market exits are substantially higher if the grandchild is a daughter's child compared to a son's child. This hints that the matrilineal advantage, i.e., that maternal grandmothers have closer ties to their grandchildren than paternal grandmothers (Brunello and Yamamura, 2023; Chan and Elder, 2000), may come at a price.

Differences depending on cohabitation/marital status of grandparents. Panel (f) in Figure 3 shows the effects of the first grandchild on earnings, depending on cohabitation/marital status of the grandparent. Single grandmothers experience the largest grandchild penalty, in terms of a drop in earnings of 10.1 percent, compared to single grandfathers.²² The

²⁰Similarly, Rutigliano et al. (2023) show that daughters are more likely to move closer to their mothers during their first pregnancy and that mothers are more likely to move closer to their daughters when the daughters' children are older than 2.5 years.

²¹In Figure A11 we examine the labor market dynamic of grandparents in families with no maternal grandmother and find qualitative similar results.

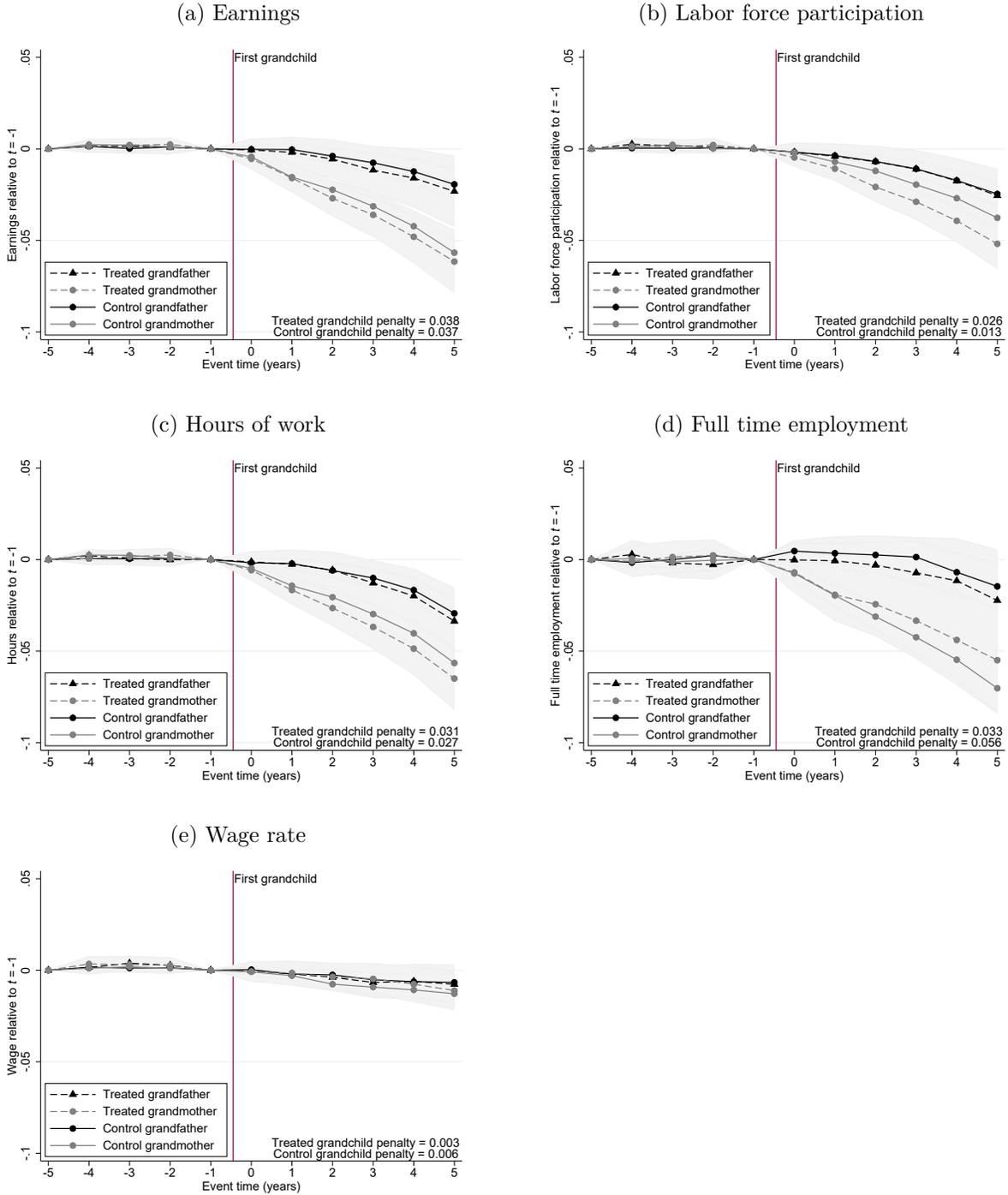
²²While single grandfathers do not adjust labor supply, our findings may reflect that single grandfathers contribute towards the younger generation by transferring money, while single grandmothers and grandparents in a couple contribute time.

coordinated reaction of married/cohabiting grandmothers and grandfathers is in accordance with a vast literature showing that spouses generally value joint leisure (Browning et al., 2021) and coordinate their retirement in old age (Bingley and Lanot, 2007; Garcia-Miralles and Leganza, 2021).

4.2 Policy: Reform of the pension system

In section 4.1, we showed that the grandchild penalty in earnings is substantially larger for the universe of grandparents born before or in 1946 than for the universe of grandparents born after 1946. In this section we zoom in on cohorts of grandparents born 1942–1951. While individuals born in or before 1946 could leave the labor market at age 50 through early retirement options, cohorts born in 1947 and after could, at the earliest, retire at age 60. We restrict the sample to five cohorts on each side of the policy change to ensure similarity across cohorts while still being able to include individual, year, and age effects in our specification. Figure 4 shows the event time coefficients for treated and control grandparents estimated from Equation (3) separately for grandmothers and grandfathers. At event time 5, the earnings of treated grandmothers have fallen by 6.2 percent compared to the year before the arrival of the first grandchild. For treated grandfathers, the drop in earnings is 2.4 percent (panel a). The drops for grandmothers and grandfathers in the control group are of a similar size; 5.7 percent and 2 percent, respectively, resulting in a grandchild penalty in earnings of 3.8 percent for the treated cohort and of 3.7 percent for the control group. Overall, panels (b)–(e) show similar grandchild penalties for treated and control cohorts. The policy change of the early retirement options seems to have little impact on the dynamics of grandparents’ earnings around the birth of the first grandchild echoing the conclusion by Kleven et al. (2020) that public policies have only minor influence on the gender wage gap.

Figure 4: The Impact of Grandchildren and Pension Reform

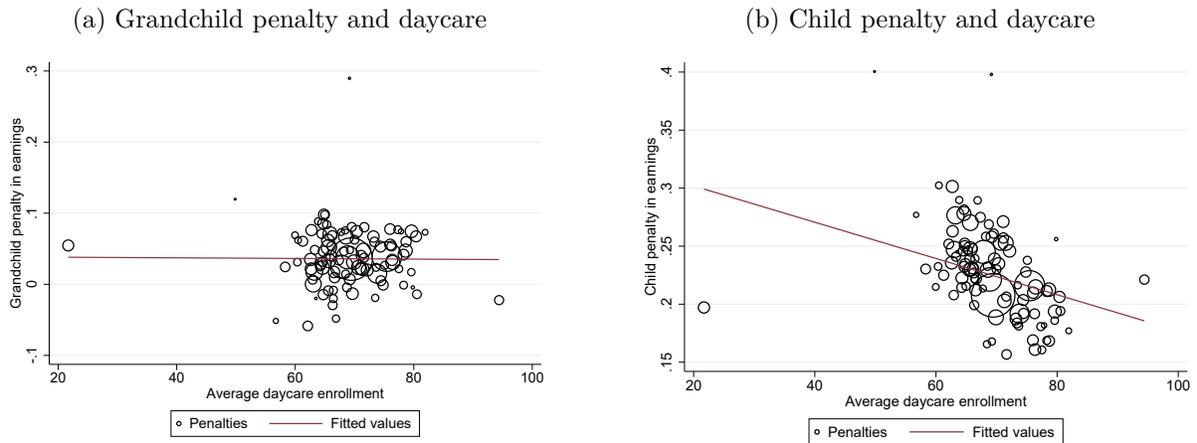


NOTE— The figure shows event time coefficients α_t^{gp} and $\alpha_t^{gp} + \delta_t^{gp}$ estimated from Equation (3) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{treat} \equiv \hat{\alpha}_t^{gp} + \hat{\delta}_t^{gp} / E[\tilde{Y}_{ist}^{gp} | t]$ $P_t^{control} \equiv \hat{\alpha}_t^{gp} / E[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately. All of these statistics are estimated on a balanced sample of grandparents born 1942–1951 who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

4.3 Policy: Evidence from spatial variation in access to daycare

To shed more light on the degree to which grandparental care works as a substitute or complement to formal daycare, we estimate child penalties and grandchild penalties in earnings separately for each municipality in Denmark and relate these penalties to spatial variation in the take-up of formal daycare. To this end, we divide the sample into 98 sub-samples on the basis of the municipality of residence of the firstborn grandchild in its birth year. Figure 5 plots the “grandchild penalty” in earnings in panel (a) and the “child penalty” in earnings in panel (b) against the average daycare enrollment for each of the 98 municipalities in Denmark. The size of the circles indicate the size of the population in the different municipalities and the fitted line is weighted by population size. Panel (a) shows that the grandchild penalties in earnings are similar across municipalities and thus uncorrelated with take-up of formal daycare in the municipalities. In contrast, panel (b) shows some evidence that the child penalties in earnings are larger in municipalities with relatively low take-up of formal daycare. While Kleven et al. (2020) find no impact of daycare availability on the child penalty in Austria, Andresen and Nix (2022) show that increasing daycare availability reduces the child penalty in Norway, and Karademir et al. (2023) confirm this result for Canada. In addition, Karademir et al. (2023) find that formal daycare works as a substitute for regular care provided by grandmothers but as a complement to low-intensity informal care by grandmothers. Given the relatively high take-up of formal daycare in Denmark, the evidence in Figure 5 suggests that the child care provided by grandparents works more as a complement than a substitute for enrollment in formal daycare. In section 4.5, we investigate if grandparents do more child care during specific hours of day to better understand if grandparents, e.g., are supporting flexibility in their children’s work schedules by providing care outside the openings hours of daycare centers.

Figure 5: Spatial variation in the Impact of Grandchildren and Children



NOTE— The figure plots the “grandchild penalty” in panel (a) and the “child penalty” in panel (b) against average daycare enrollment for each municipality. The size of the circles indicate the size of the population in the municipality. The fitted lines are weighted by population size. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild and the parents of their first grandchild.

4.4 Intergenerational Analysis of Penalties

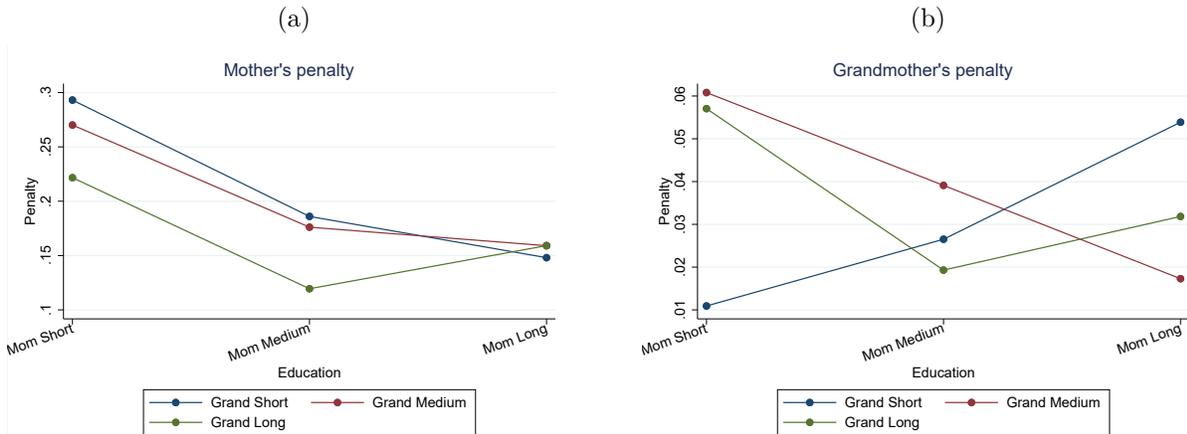
Recent literature suggests that having access to grandparents benefits young mothers’ labor supply (Posadas and Vidal-Fernandez, 2013; Zanella, 2017). One may therefore speculate whether grandmothers can relieve part of their daughters’ child penalty by reducing their own labor supply, suggesting substitution in penalties across generations, or whether child penalties are positively correlated across generations, which suggests that norms for child care arrangements are transmitted across generations (supporting, e.g., Kleven et al. 2020). We next explore whether child and grandchild penalties correlate across generations. Given that child penalties vary across education (Kleven et al., 2019b), we estimate penalties for grandmothers and their daughters separately by combinations of three main education groups.

Figure 6 shows child penalties for mothers (panel a) and grandmothers (panel b) by the mothers’ and grandmothers’ education, respectively.²³ In panel (a) of Figure 6 we find that child penalties are substantially lower for mothers with long education (around 15 percent)

²³Low education is no education beyond primary school, medium education is some secondary education, and high education refers to college and above.

as compared to mothers with short education (22–29 percent). Mothers with low education in general experience high child penalties, but within this group, child penalties are relative lower if grandmothers have long education. Panel (b) of Figure 6 furthermore shows that grandmothers experience high grandchild penalties (5.4 percent) if they have a short education and their daughter has a long education, suggesting perhaps a transfer of the penalty from the high-educated daughter to the low-educated grandmother. However, grandmothers with short education experience fairly low penalties if their daughters also have little education, indicating no shift in the penalty from daughter to mother. Finally, grandmothers’ penalties are higher if their daughters have short education in combination with grandmothers having medium or long education, suggesting perhaps a desire of the higher-educated grandmothers to support their daughters, perhaps through their studies.

Figure 6: Penalties for mothers and grandmothers by education



NOTE— The graphs focus on childbirths where the first grandchild is born by the daughter of the grandparents. The point estimates show child and grandchild penalties by mothers’ and grandmothers’ education.

4.5 Grandparents’ child care time and the flexibility it provides

We have documented that the impact of grandchildren are larger for grandmothers than grandfathers resulting in a substantial grandchild earnings penalty. Furthermore, we found no evidence that grandmothers’ care is substituting for formal child care centers. In this section, we pull together additional information from Danish time use surveys to understand

whether there are indeed gender differences in the time spent with grandchildren and when during the day grandparents provide child care time. Because the survey samples are drawn from the administrative data, and maintained by Statistics Denmark, we can link the time use surveys back to the registers. This feature allow us to observe 5,111 time spells for 2,446 of the grandparents from the main sample pooling the data from the three time use surveys conducted in 1987, 2001 and 2008. Table 2 shows that, among these grandparents, 11.8 percent of the grandmothers and 10.8 percent of the grandfathers report doing some child care on at least one of the diary days. Furthermore, conditional on doing some child care, grandmothers spend 163 minutes (2.7 hours) per day while grandfathers spend 131 minutes (2.2 hours) per day doing child care activities.²⁴ Suggesting that while grandmothers and grandfathers are about as likely to do some child care, the amount of care provided by grandmothers are larger than the amount of care provided by grandfathers.²⁵

Panel (a) of Figure 7 shows grandparents' child care time by age of their first grandchild. We find that grandmothers spend more time doing child care when their firstborn grandchild is 3–5 years old, and that child care time of grandmothers and grandfathers, respectively, converge when their firstborn grandchild is 9–11 years old, indicating that grandmothers play a more active role than grandfathers when their grandchild is younger and needs more care.²⁶ Grandmothers whose first grandchild is 3–5 spend on average about 180 minutes per

²⁴Using all the linked time use spells, Appendix Table A1 reports differences in child care time across the dimensions of our heterogeneity analysis. While grandfathers spend significantly less time with their grandchildren compared to grandmothers, we also observe that maternal grandmothers spend more time with grandchildren than paternal grandmothers. This matrilineal advantage in grandparenting is common across developed countries (Brunello and Yamamura, 2023; Chan and Elder, 2000). Moreover, we observe that grandparents who live alone spend more time doing child care than grandparents who live in a couple. Furthermore, we observe that grandparents spend more time with children born after the 2002-extension of parental leave, and that grandparents with a grandchild living in a municipality with high (above mean) daycare enrollment spend more time doing child care than grandparents with a grandchild in a low daycare municipality. This finding confirms that grandmothers complement, rather than substitute, formal child care routes.

²⁵Using numbers from the American Time Use Surveys (ATUS), Rupert and Zanella (2018) report that 16 percent of women and 11 percent of men in the age range 50–64 spend time in primary child care activities with annual hours of child care being 657.1 for women (around 1.8 hours per day) and 500.9 for men (around 1.4 hours per day) among those who do report at least some child care time.

²⁶Using data on 3,228 grandparents from SHARE, where people are asked how often they care for children, Appendix Figure A12 confirms that 15 percent of grandparents with grandchildren aged 1–5 provide care for their grandchildren on a daily or weekly basis (panel a), and grandmothers spend more time with their

Table 2: Grandparents Doing Child Care Activities

	(1)	(2)
	Grandmother	Grandfather
<i>Fraction doing child care</i>		
Doing child care	0.116 (0.321)	0.108 (0.311)
Individuals	1274	1172
<i>Time in child care conditional on doing some child care</i>		
Child care time (minutes per day)	163.2 (150.6)	131.2 (113.8)
Observations	165	139
Individuals	147	129

Note— The table shows means and standard deviations of a dummy for doing some child care and the time in child care activities conditional on doing some child care separately for grandmothers and grandfathers. SOURCE— Danish Time Use Surveys from 1987, 2001, and 2008 linked to register data.

day or 3 hours per day doing child care. This observation is consistent with the idea that grandmothers' care complements rather than substitutes formal daycare services. Research from Sweden and other developed countries also suggests that although grandmothers are not the primary caregivers of their grandchildren, they support their offspring by complementing formal daycare with after-daycare hours of additional care (Kridahl, 2017; OECD, 2019; Karademir et al., 2023).

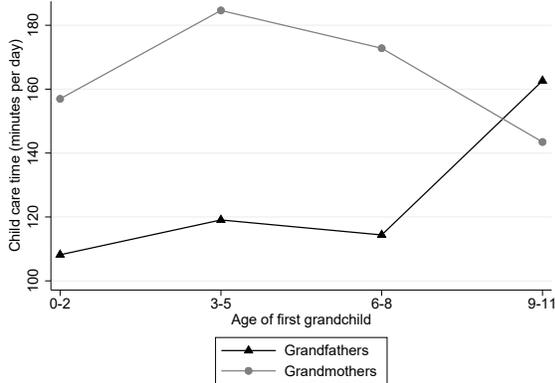
We utilize the specifics of the time spells in the diaries to examine if grandparents provide child care for their grandchildren more frequently at some points of the day (e.g., in the afternoon when formal daycare institutions close for the day). Panel (b) shows the average minutes per hour in child care activities by hour of the day. The grandparents' child care time increases gradually from 7 in the morning and peaks between 15–17 in the afternoon, reflecting perhaps that grandparents help their offspring by picking up grandchildren from daycare in the afternoon.²⁷ While the majority of grandparents time in child care activities are during the work day, time use data suggest that the amount of grandparental care is not a daily activity, instead grandparents especially grandmothers, may step in when children grandchildren than grandfathers (panel b).

²⁷Most daycare institutions close at 17:00 Monday–Thursday and at 16:00 on Fridays.

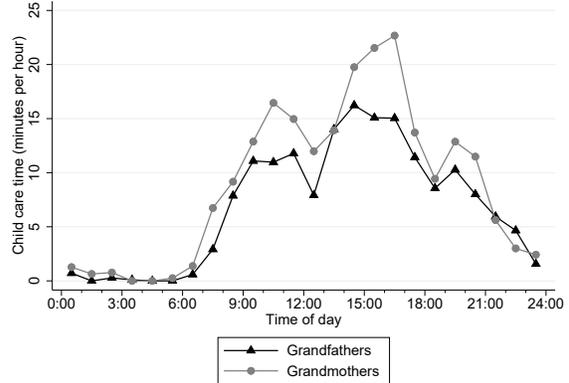
are sick or on public holidays when daycare centers are closed to offer a flexible and reliable supplement to formal child care.

Figure 7: Time in Child Care Activities by Age of First Grandchild and Time of Day

(a) Child care time by age of first grandchild for grandmothers and grandfathers



(b) Child care time by time of day for grandmothers and grandfathers



NOTE— The figure shows the time grandparents report doing child care in the time use surveys by age of first grandchild (panel a) and by time of day (panel b) for those grandparents who report at least some child care time. Panel (a) shows the average minutes per day in child care activities by age of the first grandchild for grandmothers and grandfathers separately. Panel (b) shows the average minutes per hour in child care activities by hour of the day for grandmothers and grandfathers separately.

SOURCE— Danish Time Use Surveys from 1987, 2001, and 2008 linked to register data.

4.6 Gender norms for work

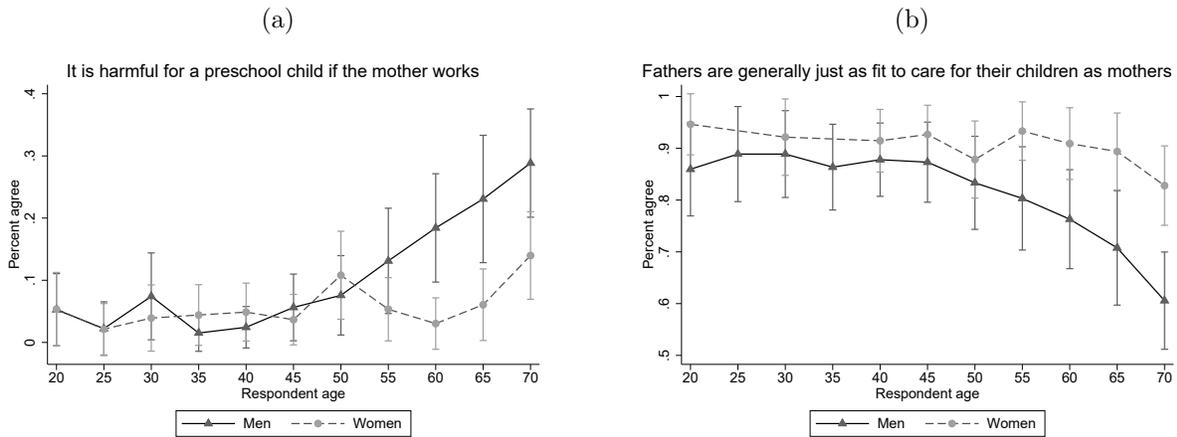
The economic literature on the effects of childbirth on women’s labor supply emphasizes the role of social norms related to gender in families’ division of work in the household and in the market (Bertrand, 2011).²⁸ We hypothesize that labor supply responses of grandparents following the birth of the first grandchild are guided by concerns along two dimensions: 1) Attitudes towards young parents’ (mothers’) labor force participation, and 2) Attitudes towards labor force participation of elderly (women) and the appropriate retirement age.

²⁸Kleven et al. (2019b) find that countries with large child penalties represent more gender-conservative views and further document that girls growing up in families with more traditional gender roles experience larger child penalties than otherwise. Moriconi and Rodríguez-Planas (2021) find a positive association between non-traditional norms in the grandmothers’ cohort and mothers’ decision to work when having a preschool child relative to childless women. Furthermore, Cortés et al. (2022) show through an information experiment that most people overestimate how gender conservative their peers are and that individual beliefs are sensitive to information on social norms of their peers.

We analyze such attitudes using data from the Danish parts of two international surveys, the European Value Survey (EVS) wave 4 from 2008 to analyze attitudes to young women working, and the European Social Survey (ESS) wave 3 from 2006 to investigate attitudes to elderly women and men working. Regarding the first dimension, attitudes towards young mothers working, we find that there is a gender difference among older cohorts in their views on fathers' and mothers' responsibilities in terms of parenting for young children. Figure 8 shows the percentages of men and women who agree with the following two statements: (a) *It is harmful for a preschool child if the mother works* and (b) *Fathers are generally just as fit to care for their children as mothers*. While there is little difference in the shares of men and women below age 50 who agree with these two statements, the gender gaps in responses open up after age 50. Thus, the share of men above age 50 agreeing with statement (a)—claiming that it is harmful for children if their mothers work—is significantly higher than the share of women above age 50 agreeing with the statement. Similarly for statement (b), a gender divergence opens up after age 50 in the percentage of people who agree with the statement that fathers are just as good caregivers as mothers. This may reflect that potential grandfathers are less supportive of their daughters or daughters-in-law working in the labor market (panel a), and moreover that they may themselves be reluctant to take care of young children in the capacity of being grandfathers (panel b). Interestingly, there is no strong age gradient in women's attitudes to mothers working, which may explain why grandmothers are willing to adjust their own labor supply to assist their children's career by caring for their grandchildren.

We next explore how gender roles for elderly women may impact their labor market participation when becoming grandmothers. European Social Survey wave 3 from 2006 asks: *At what age are men/women too old to work more than half-time?* Figure 9 shows the age that men (panel a) and women (panel b) find that a man and a woman, respectively, are too old to work more than half-time. Panel (a) suggests that men find that men can be working more than half-time until a higher age than what they think is appropriate for women. At

Figure 8: Social norms for mothers working and fathers caring for children

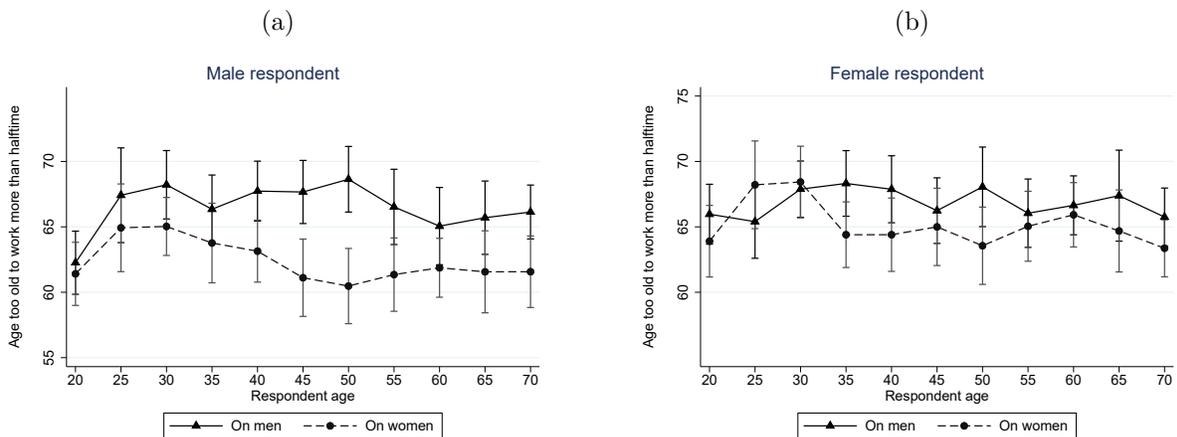


NOTE— The figures show responses to two statements in the European Value Survey (EVS) from 2008: (a) It is harmful for a preschool child if the mother works, and (b) Fathers are generally just as fit to care for their children as mothers. The figures show margins plots of estimated marginal effects from a regression of survey responses by respondent gender and age. The bars indicate 95 percent confidence intervals from a t-test.

SOURCE— European Value Survey wave 4, 2008.

respondent age 50, the difference in years is more than 10 percent. We also observe that while male respondents reported that men can be somewhat older than women and still keep working, female respondents did not express similar responses in terms of working ages.

Figure 9: Age of being too old to work more than halftime



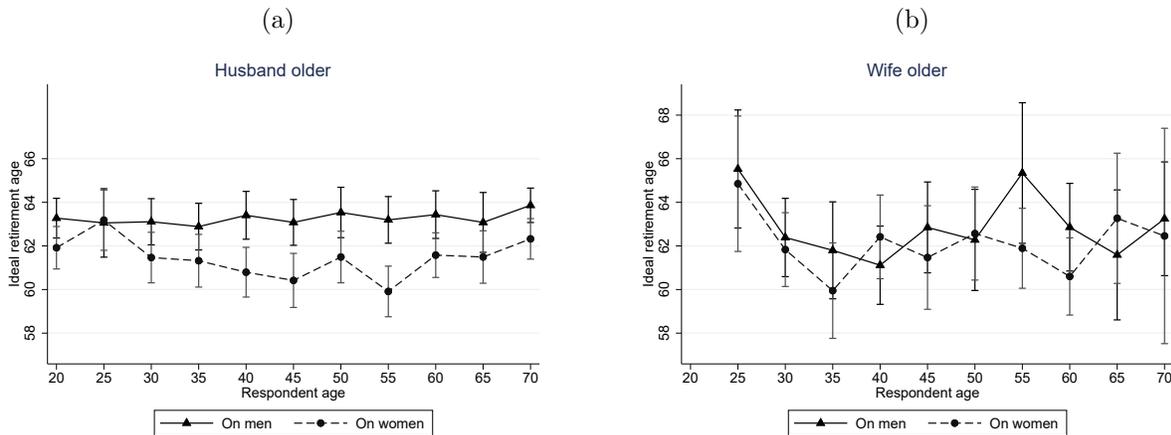
NOTE— The figures show responses to a question in the European Social Survey (ESS) from 2006: “At what age are men/women too old to work more than half-time?”. The figures show margins plots of estimated marginal effects from two separate regressions of male and female responses to the survey question estimated on respondent. The bars indicate 95 percent confidence intervals from a t-test.

SOURCE— European Social Survey wave 3, 2006.

Finally, we explore in Figure 10 what men and women find is the ideal retirement age. Women usually retire earlier than men, possibly due to the fact that husbands are on average two years older than their wives combined with the fact that couples have a preference for coordinated leisure in general (Browning et al., 2021), and for coordinated retirement in particular when approaching old-age (Garcia-Miralles and Leganza, 2021). To illustrate this, we split the sample according to which of the partners is the older spouse in the couple. We find that in couples where the husband is older (panel a), the ideal retirement age of men is on average two years older than the ideal retirement age of women. We do not find any difference in ideal retirement age for couples with an older wife (panel b).

Overall, our findings point to some strong gender differences that we ascribe to social norms on women’s work in different stages in life. Such gender norms suggest that couples may find it more “natural” for women to reduce their labor supply when becoming grandmothers than for men to reduce their labor supply when becoming grandfathers.

Figure 10: Ideal retirement age



NOTE— The figures show responses to a question in the European Social Survey (ESS) from 2006 regarding what is the ideal retirement age for a man and a woman, respectively. The figures show margins plots of estimated marginal effects from two separate regressions on respondents in couples where the husband was older (a) and the wife was older (b). Survey responses are regressed on respondent age. The bars indicate 95 percent confidence intervals from a t-test.

SOURCE— European Value Survey 2006.

5 Conclusion

Recent research documents a sizable and persistent child penalty as measured by a drop in earnings for women compared to men after the birth of the first child (Kleven et al., 2019a,b; Sieppi and Pehkonen, 2019). The child penalty, which is found across several developed countries, contributes to gender inequality over the work life. Decades of child care subsidies and maternity leave policies seem to have achieved little in terms of closing the gender earnings gap (Kleven et al., 2020; Olivetti and Petrongolo, 2017; Rossin-Slater, 2017). The availability of grandparental care can be an important factor—grandmothers transfer a substantial amount of time to their children, and this positively affects maternal labor supply among young mothers (Del Boca, 2002; Bratti et al., 2018; Zamarro, 2020).

Our paper extends this literature by documenting that the gender gap is further carried on into old age in the form of a grandchild penalty. Using a quasi-experimental approach and exploiting unique and rich administrative data for Denmark, we show that the persistent gender gap is reinforced by the arrival of grandchildren and thus continues into retirement age. Following Kleven et al. (2019b), we employ a quasi-experimental approach to estimate the causal effects of the birth of the first grandchild. Our event study allows us to document the dynamic trajectories on earnings, wage rate, labor force participation, full time employment, hours of work, and pension savings after having the first grandchild. We show after the arrival of the first grandchild, female earnings start dropping in comparison to male earnings, which are largely unaffected when we control for year, age and individual effects. Five years after the arrival of the first grandchild, the gender gap in earnings has widened by 3.8 percent. This effect is almost entirely driven by reductions in full time employment. Thus, the child penalty due to fertility strikes again when women enter grandparenthood, although to a smaller extent. We also explore the long-run effects 10 years into grandparenthood, estimating an earnings penalty of 10.1 percent and a gender gap in labor force participation of 4.5 percent 10 years after the birth of the first grandchild.

Our main results are robust to the specification of the event study. A comparison of our

event study estimates of the gender gap in labor market outcomes to a DiD event study design confirms our main results. To shed light on some potential mechanisms, we furthermore explore the effects across different groups and time periods, leading to several interesting additional insights. First, we investigate the results by two sub-periods, 1985–2001 and 2002–2012. We show that the gender earnings gap is somewhat stronger for the earlier period, in which parental leave was remarkable shorter, options for early retirement were much more generous, and daycare availability more scarce than in later periods. At the same time, female labor supply was generally lower and part time work more prevalent for women becoming grandmothers in this period. Second, we find larger grandchild penalties for cohorts of grandparents who had access to more generous early retirement routes. However, a pension reform increasing the early retirement age has little impact on the grandchild penalty per see. Third, we find slightly larger grandchild penalties for grandmothers whose firstborn grandchild lives in a municipality with relatively high coverage of formal daycare. This result, in combination with the results on reductions in full time employment, suggest that grandmothers reduce their work hours to provide informal flexible child care for their grandchildren as a complement to the care received in formal daycare centers. Fourth, we find that labor market effects for grandparents are stronger if grandparents and children live closer by. Fifth, we find that the effects of becoming a grandparent vary by the gender of the child (the parent of the grandchild). Thus grandmothers are significantly more likely to reduce their work hours if it is their daughter who gives birth to a grandchild relative to their son. This suggests that the inclination to transfer time across generations is stronger in the mother-daughter relationship than in the mother-son relationship. Finally, we find very different effects for grandparents who are single compared to grandparents who live in couples. We find the strongest negative effects on labor market outcomes for single grandmothers. For couples, the labor market outcomes move more closely together, but the grandchild penalty is still substantial.

We further explore whether the child care burden is shifted across generations, suggesting

a substitution in child penalties between mothers and grandmothers, or whether child penalties across generations are positively correlated, suggesting perhaps that family norms may be passed down across generations as discussed in Kleven et al. (2019a). Using a combination of child and grandchild penalties estimated on our sample, we investigate how these penalties correlate across several dimensions. Our findings suggest that daycare coverage plays a large role for child penalties, but not for grandchild penalties. Moreover, we observe some inter-generational transfer of child penalties in dynasties with a low-educated grandmother and a high-educated mother, whereas we find low child and grandchild penalties when young mothers are medium- or high-educated and have mothers (grandmothers) with equally high education. The latter result may be an indication of a positive correlation in preferences for work and career across generations. Using Danish Time Use Surveys, we observe that while grandmothers do engage more in child care than grandfathers, only a minority of grandparents engage in child care. Furthermore, we observe that those that do any child care spend relatively little time doing child care. Suggesting that grandmothers may reduce their labor market hours in order to be 'on-call' ready to help their offspring with unexpected child care needs, rather than from the actual time demands for child care.

Finally, using data from European Value Survey and European Social Survey, we investigate how norms related to women's and men's work and child care vary across men and women and over age groups. From responses in European Value Survey from 2008, we find that the gender gap in attitudes towards young mother's work opens up after the age of 50, indicating that men above 50 are more critical towards mothers of young children working. Furthermore, we observe clear gender gaps in the views on older women's work. Thus, based on European Social Survey from 2006, we find that especially older male respondents respond that women should cut down on market work or retire at a younger age than what they find appropriate for men. These differences in gender norms for work at old age help explain why more older women than men reduce work when they become grandparents.

Our results point to several policy relevant insights. We establish that it is crucial to

take a broader family perspective that recognizes the provision of grandparental child care in order to reduce gender inequalities in the labor market that open up at first childbirth, expand at the arrival of the first grandchild, and persist into retirement. Eliciting how gender gaps in grandparenting contribute to inequality in old age is important as women's pension savings still fall behind men's by more than 20 percent (Fuglsbjerg et al., 2020). After decades of reductions in the gender gap in education and increasing female labor supply, grandmothers' time is no longer an unused resource to the same extent as it was perhaps 30 years ago. Pension reforms intended to postpone retirement contribute to this picture. Our research documents that trade-offs between mothers' and grandmothers' labor supply abound. Thus family policies such as subsidized formal daycare may not yield the intended payoffs if such trade-off are neglected (Havnes and Mogstad, 2011). This calls for policies that sustain grandparents' stay in the labor force while supporting young parents' labor market attachment.

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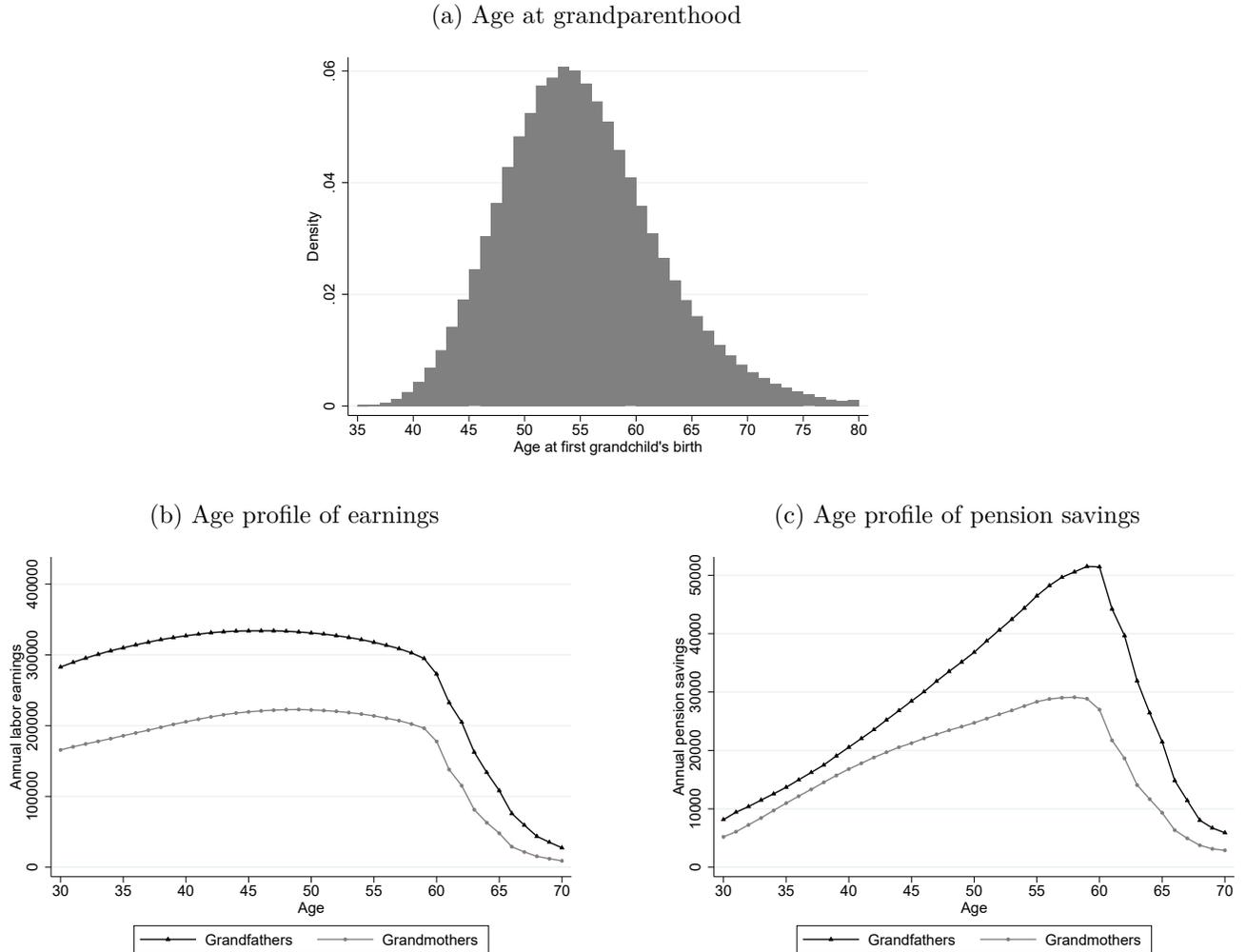
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A Appendix

A.1 Grandparenthood and age

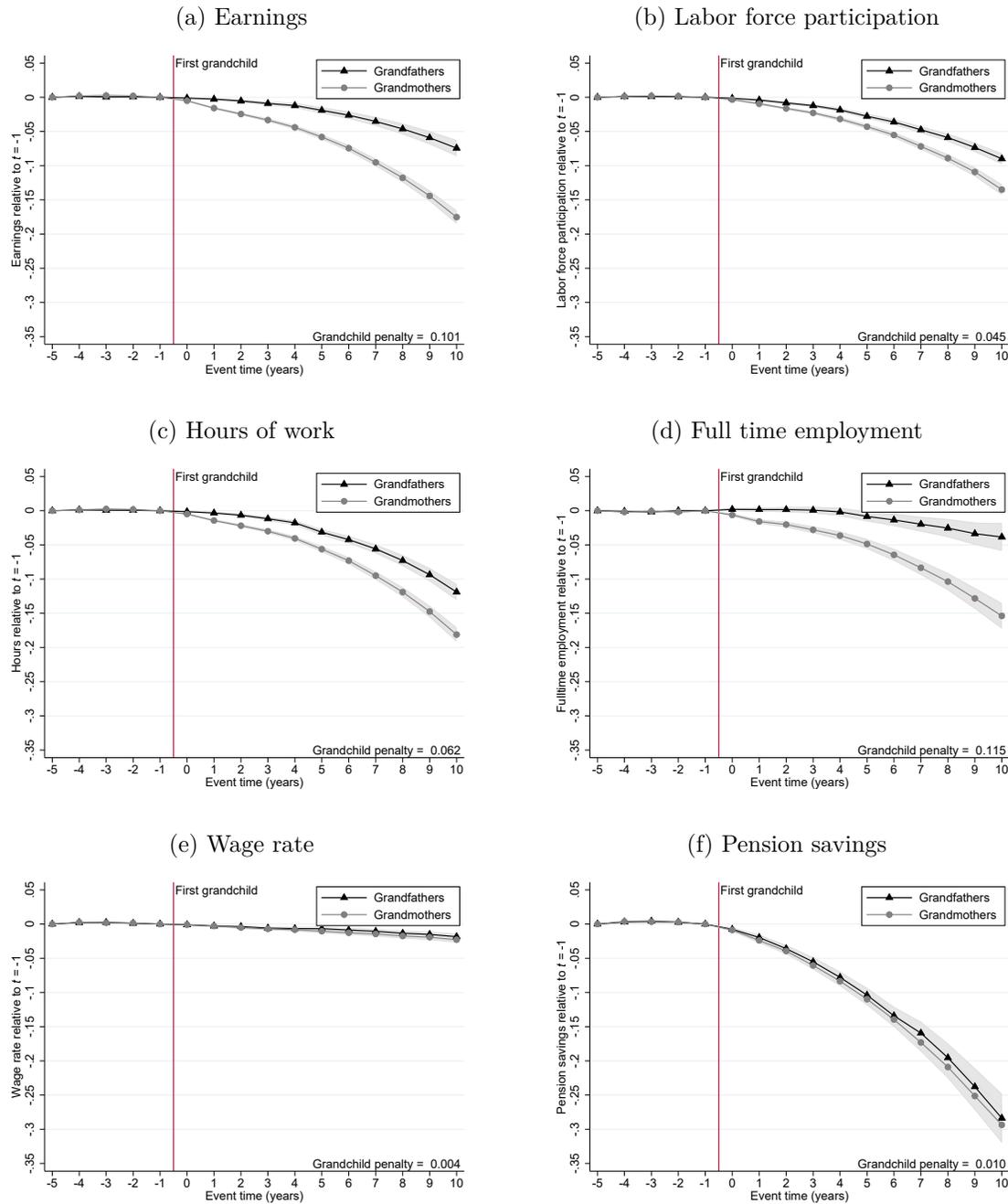
Figure A1: Age at Grandparenthood, Earnings and Pension Savings across Age



NOTE— The figure in panel (a) shows the distribution of age at the birth of the first grandchild for all grandparents in Denmark. The figure shows annual earnings (in panel b) and annual pension savings (in panel c) between age 30 and 70 for individuals who at some point in their life become grandparents.

A.2 Long-run impact of grandchildren

Figure A2: The Long-run Impact of Grandchildren



NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome absent grandchildren for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a long-run “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, measured at event time 10. The wage effects are estimated conditional on participation. The pension savings effects are estimated on a sub-sample with grandchildren born after 2000. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

A.3 Difference-in-Differences

We additionally implement a DiD event study design to validate the results from the event study in Equation (1), particularly the long-run effects where the smoothness assumption may not hold. The DiD event study allows us to analyze the effect of having grandchildren per se, using men and women who do not (yet) have grandchildren as controls. To include non-grandparents in an event study design where the event analyzed is having one’s first grandchild, we assign “placebo” grandchildren to individuals born 1930–1977 who have at least one child above age 19 but no grandchildren. To achieve a suitable control group, we mimic the distribution of age at first grandchild observed among the sample of grandparents within each birth cohort. As before, we base our analysis on a balanced panel of 1,550,960 individuals, adding 357,214 people without grandchildren to our sample of grandparents. The DiD analysis thus compares individuals observed in a ten year window around the birth of their first grandchild to individuals observed in a ten year window around the placebo assignment of a grandchild:

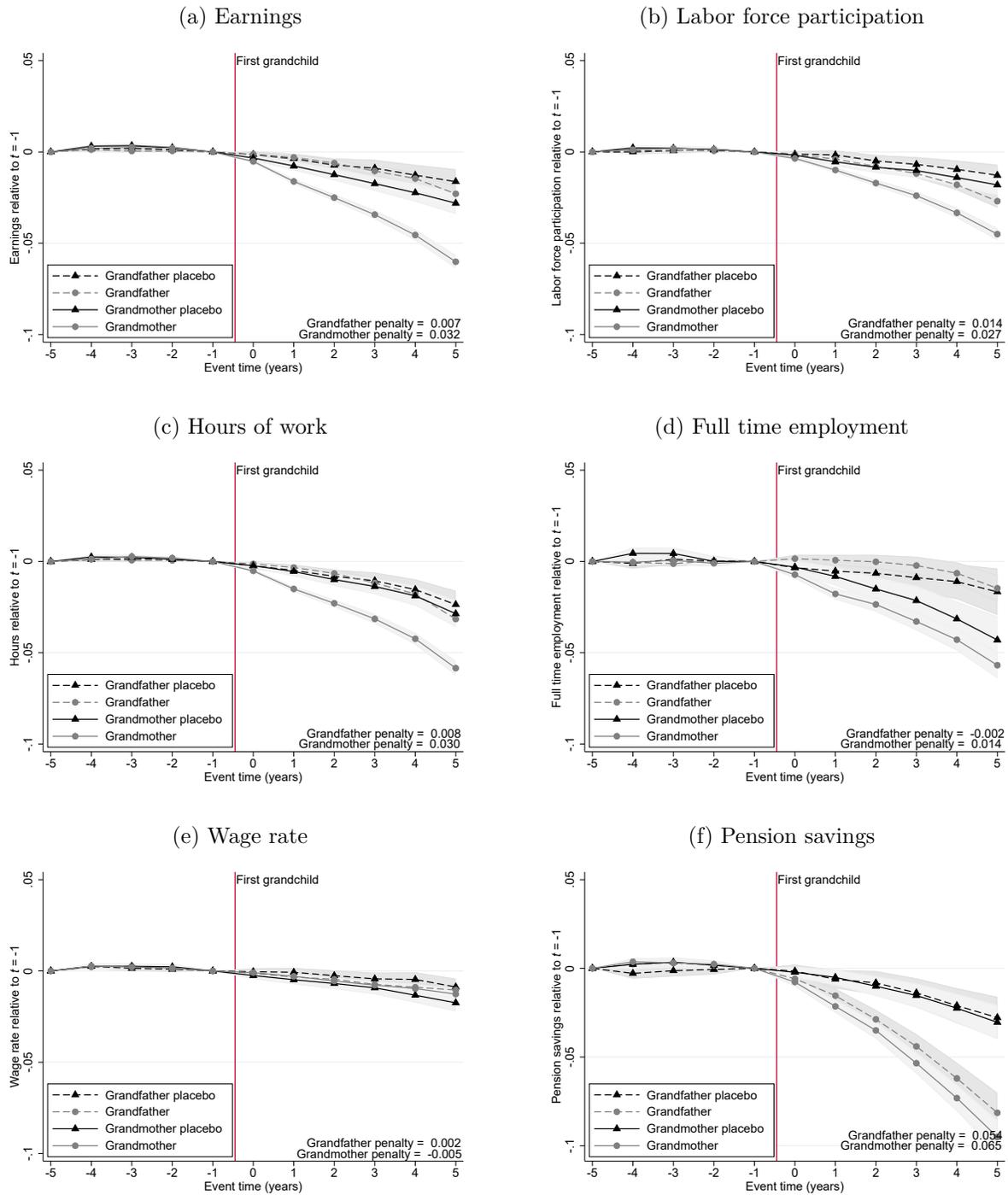
$$E[Y_{i,t>0} - Y_{i,t<0}|gc_i > 0] - E[Y_{i,t>0} - Y_{i,t<0}|gc_i = 0], \quad (4)$$

where t denotes the year the grandchild (or placebo grandchild) arrives, $gc_i > 0$ for individuals i who have at least one grandchild, and $gc_i = 0$ for people who have been assigned a placebo grandchild. Identification of Equation (4) relies on the usual parallel trends assumption, which we validate by estimating the pre-trend. Including a control group allows us to construct a “grandchild penalty” as the percentage by which grandmothers (grandfathers) fall behind relative to non-grandmothers (non-grandfathers) due to the arrival of a grandchild at event time t :

$$P_t \equiv \frac{\hat{\alpha}_t^{ngp}}{\mathbb{E}[\tilde{Y}_{ist}^{ngp}|t]} - \frac{\hat{\alpha}_t^{gp}}{\mathbb{E}[\tilde{Y}_{ist}^{gp}|t]}, \quad (5)$$

where ngp refers to non-grandparents and gp refers to grandparents.

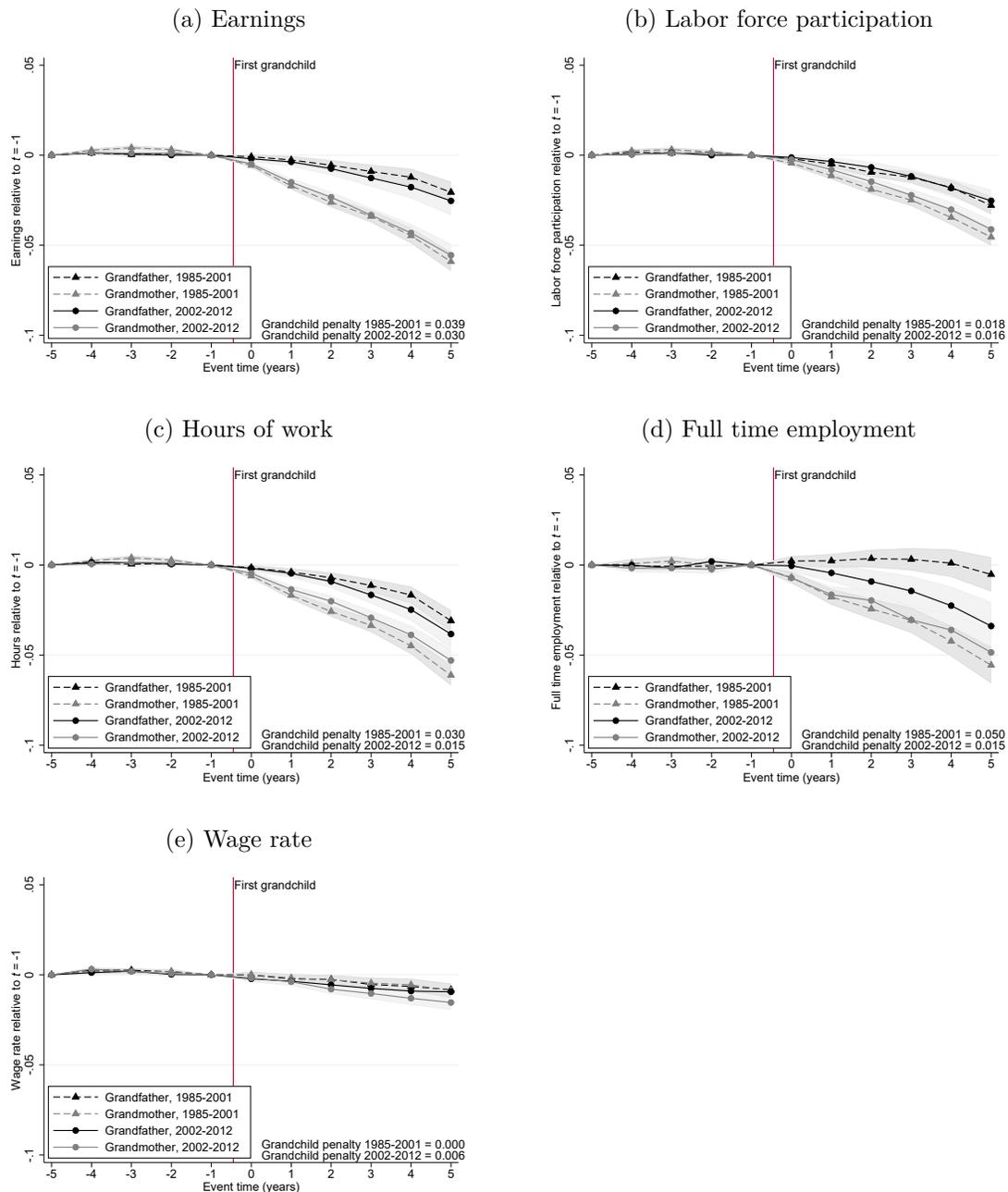
Figure A3: DiD Event Study of the Impact of Grandchildren



NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome absent grandchildren for men and women with and without grandchildren separately and for different outcomes. Each panel also reports a “grandchild penalty”, as defined in Equation (5) measured at event time 5. All of these statistics are estimated on a balanced sample of people who have (been assigned) their first grandchild between 1985—2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first (placebo) grandchild. The wage effects are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

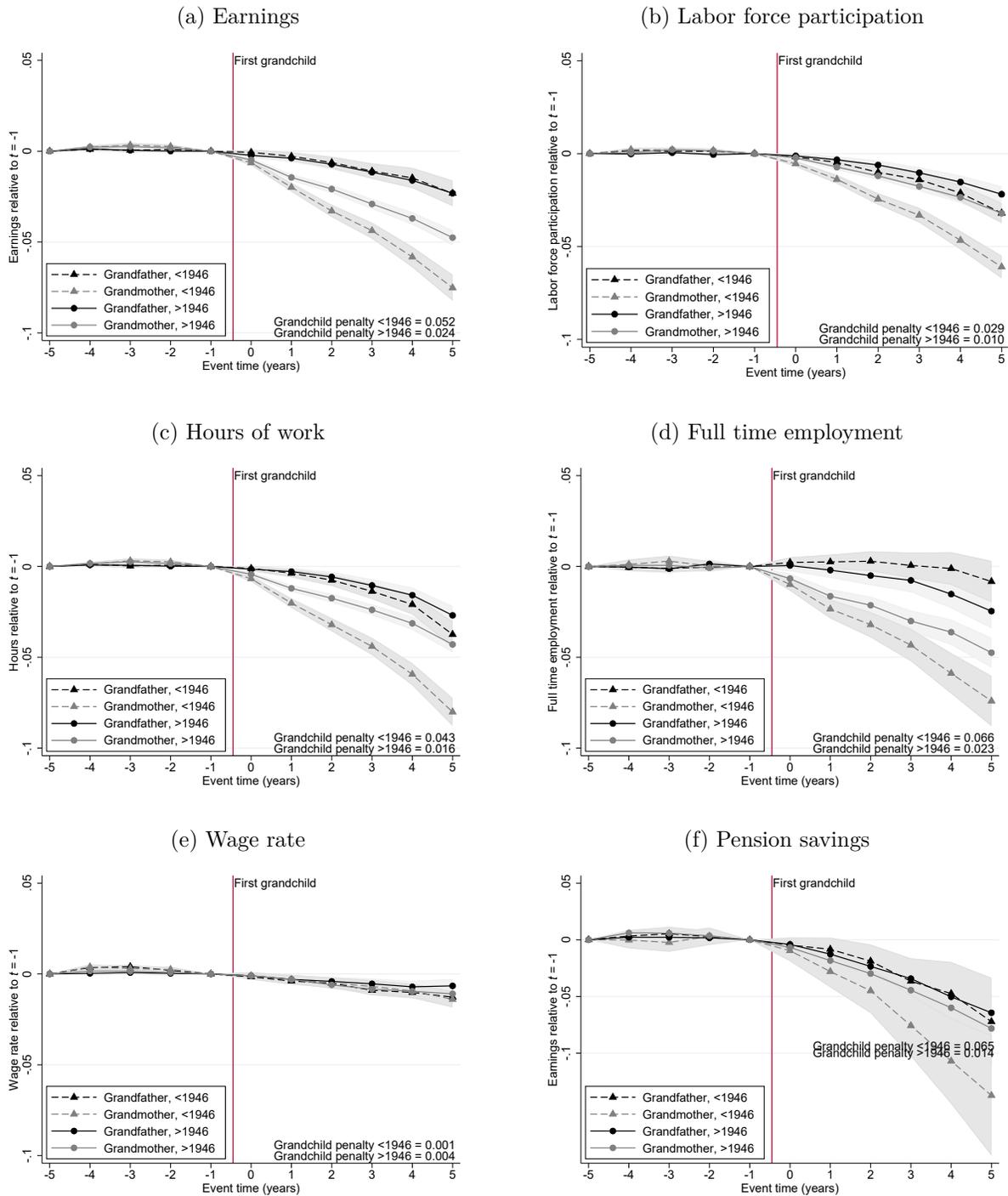
A.4 Heterogeneity in responses to grandparenthood

Figure A4: The Impact of Grandchildren by Different Time Periods



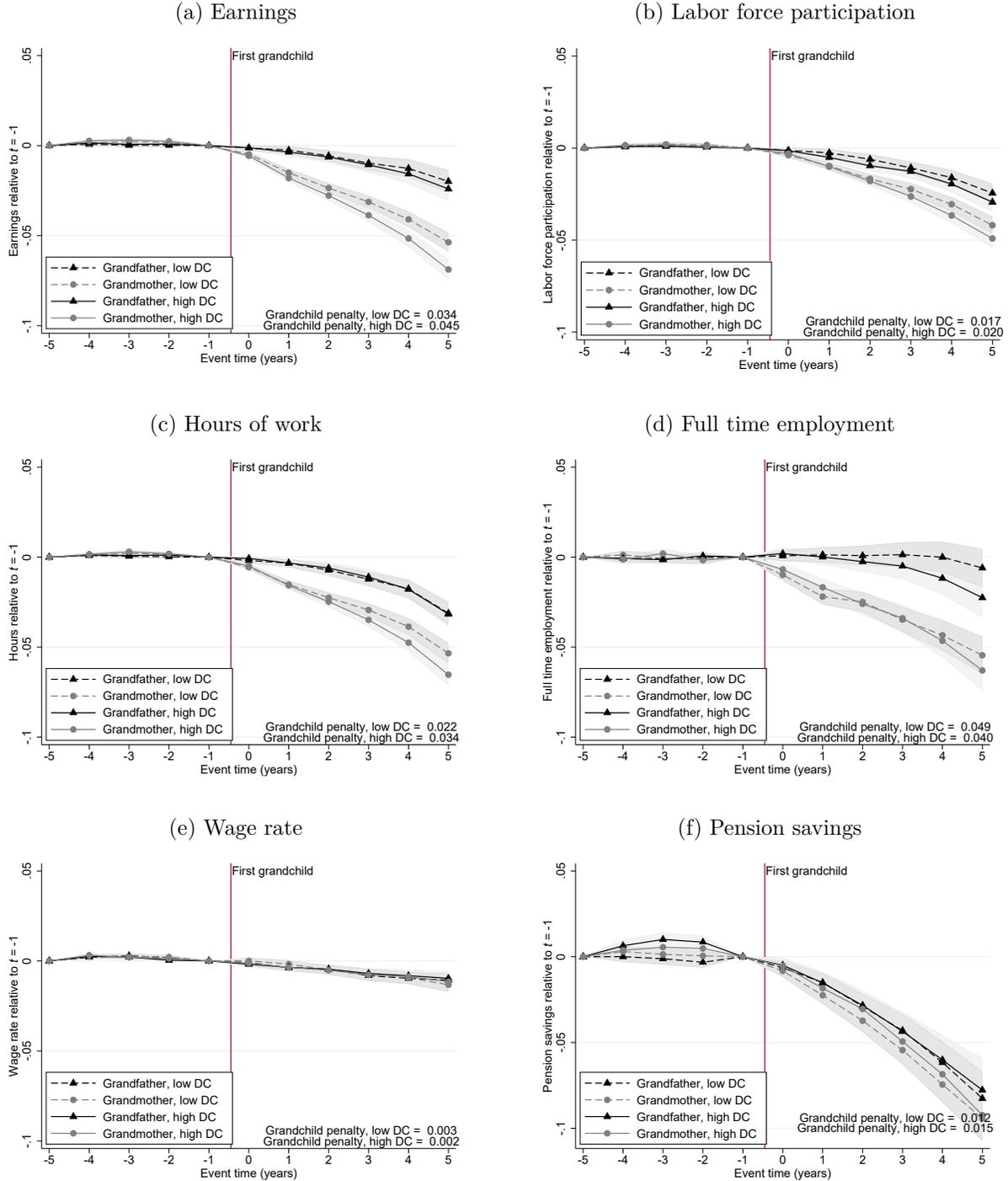
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome absent grandchildren for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren measured at event time 5, as defined in Equation (2). All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985—2000 or 2001—2012. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A5: The Impact of Grandchildren by Birth Cohorts



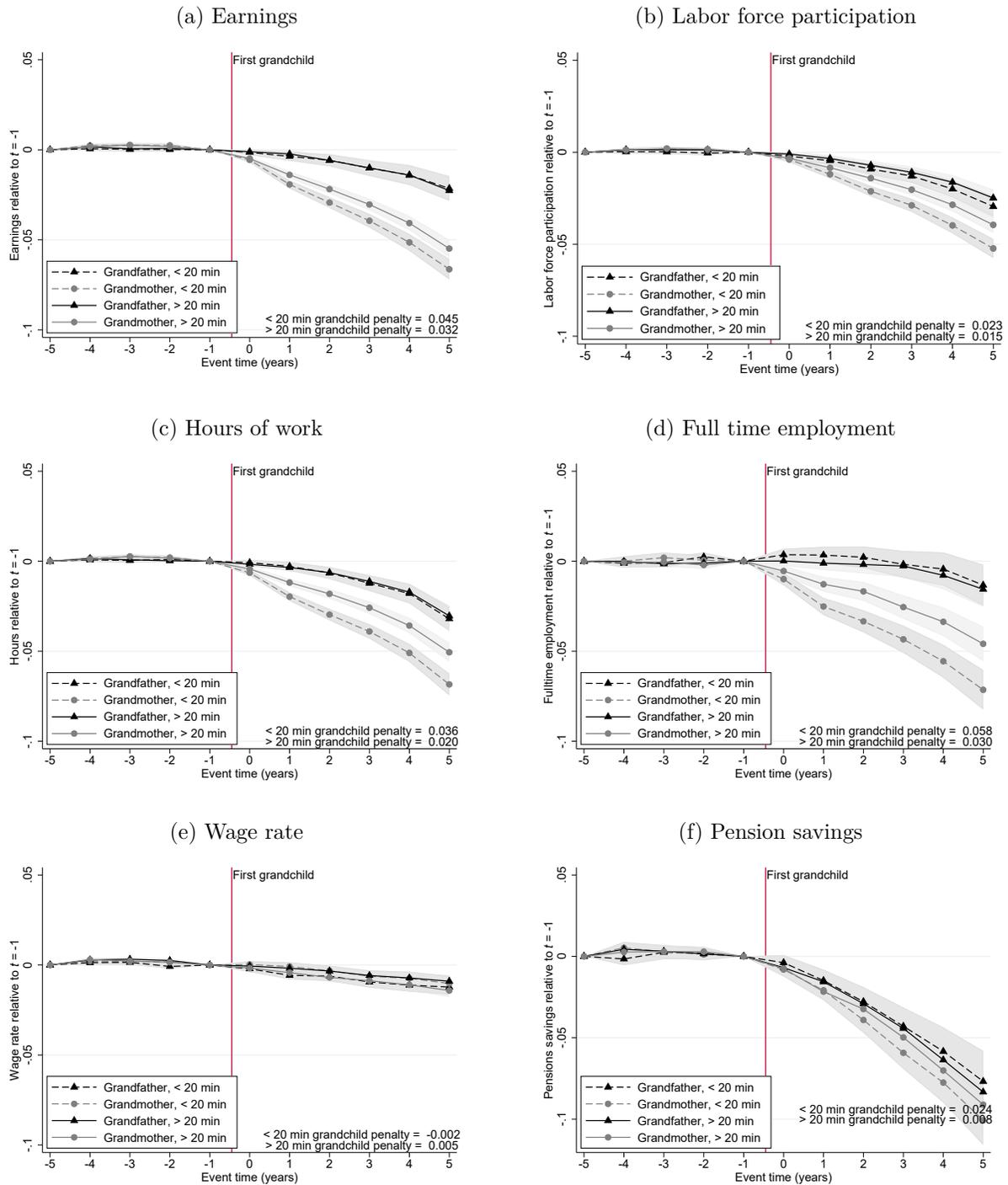
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / E[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A6: The Impact of Grandchildren by Daycare Availability



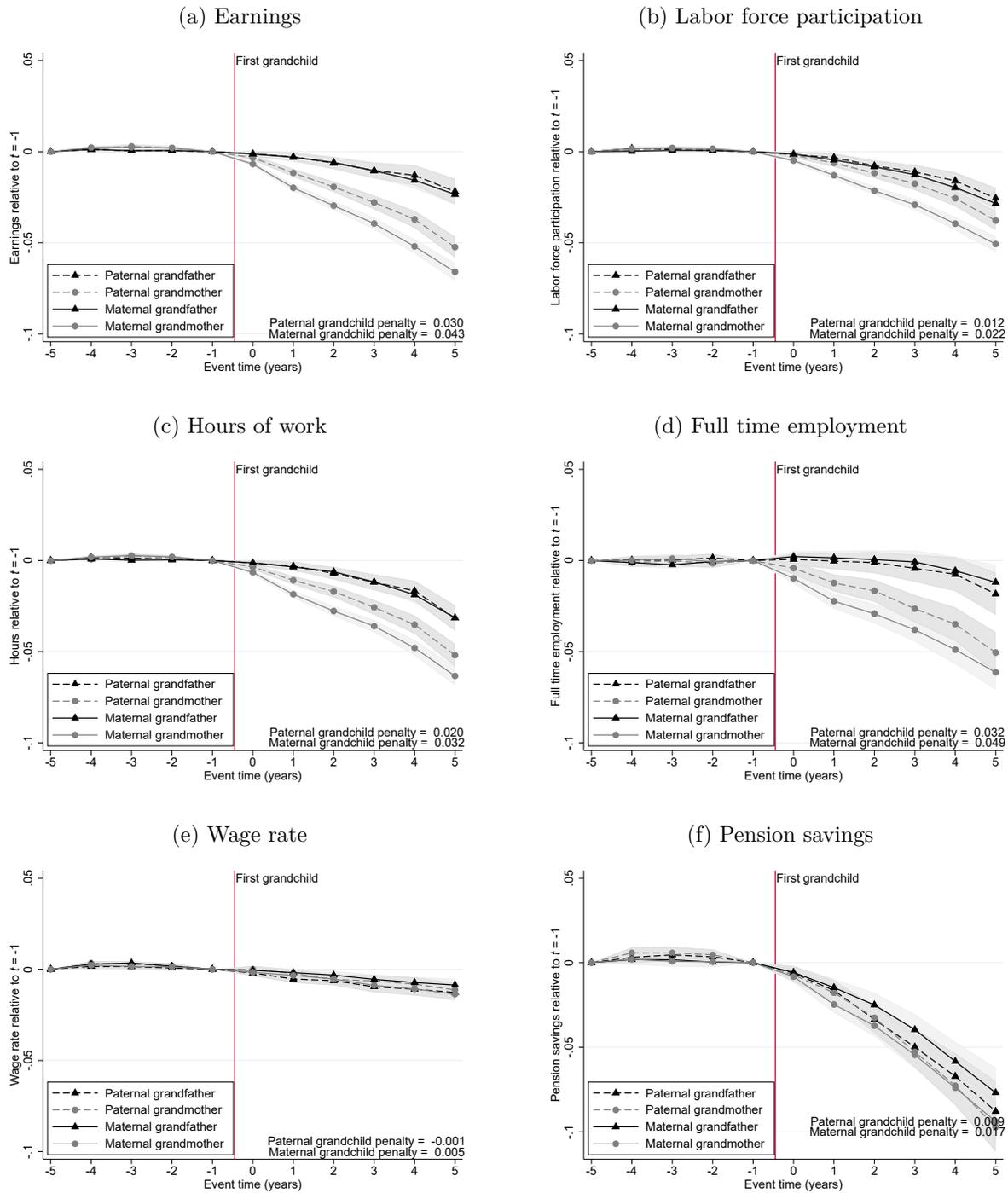
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A7: The Impact of Grandchildren by Commuting Time



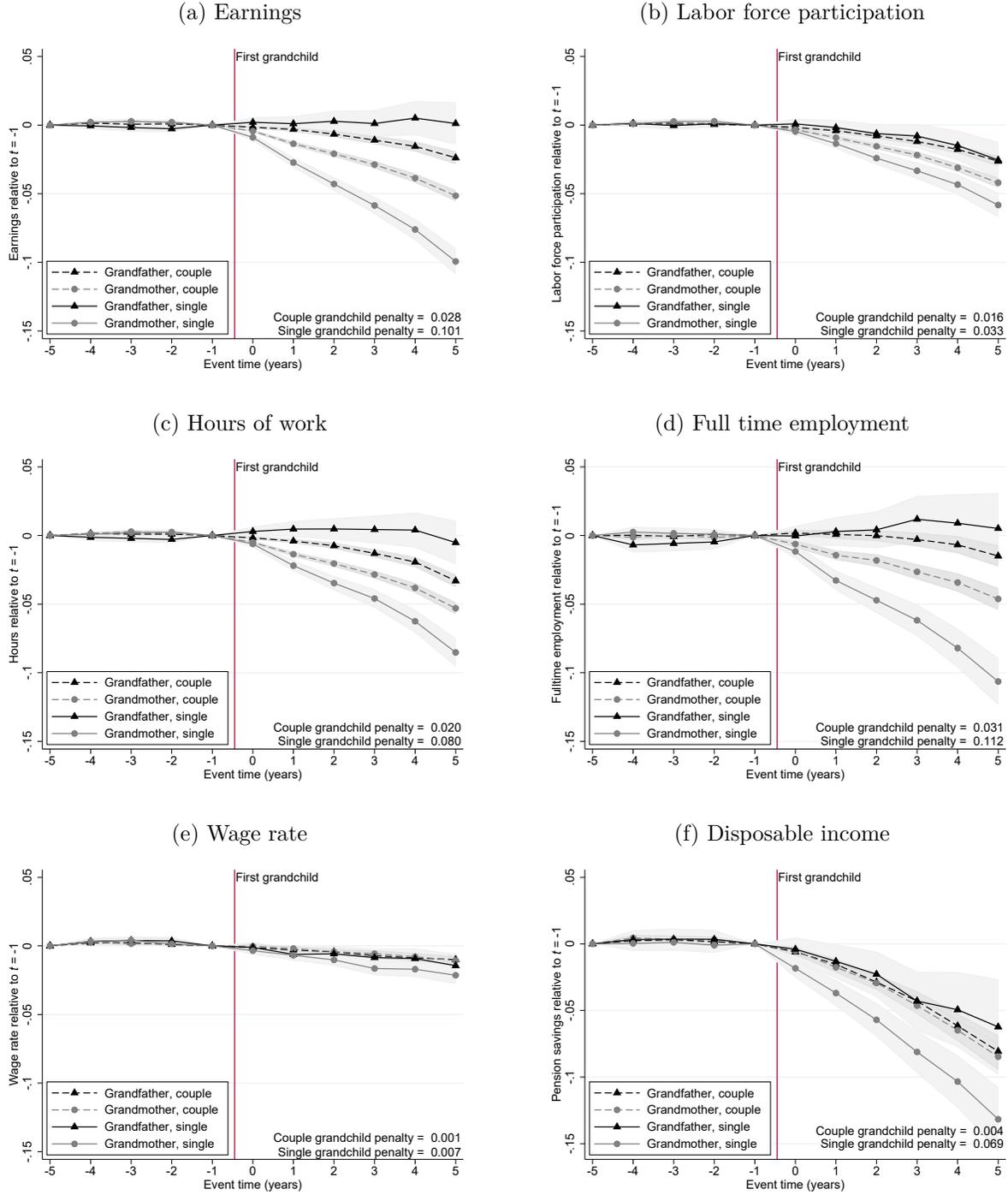
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A8: The Impact of Grandchildren by Gender of Child



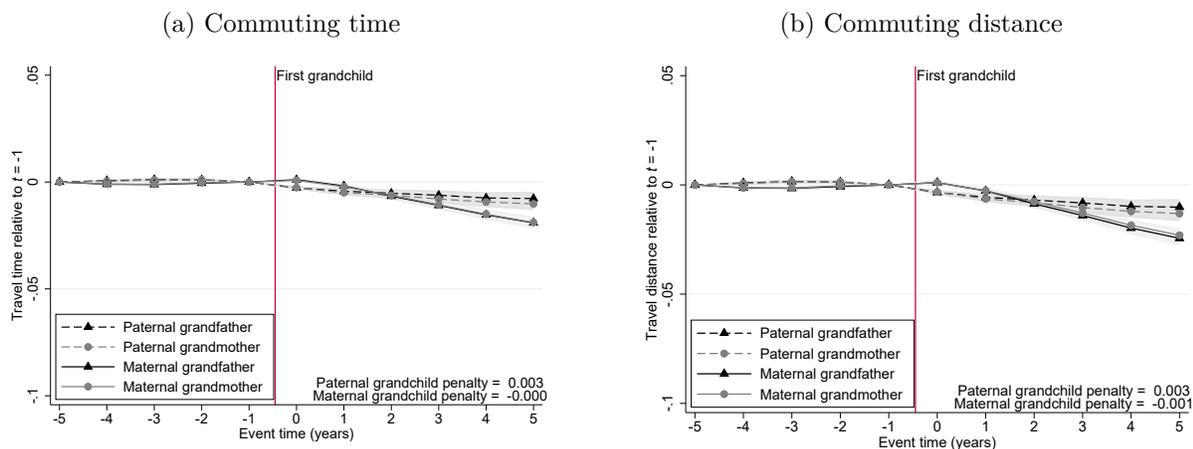
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A9: The Impact of Grandchildren by Marital Status



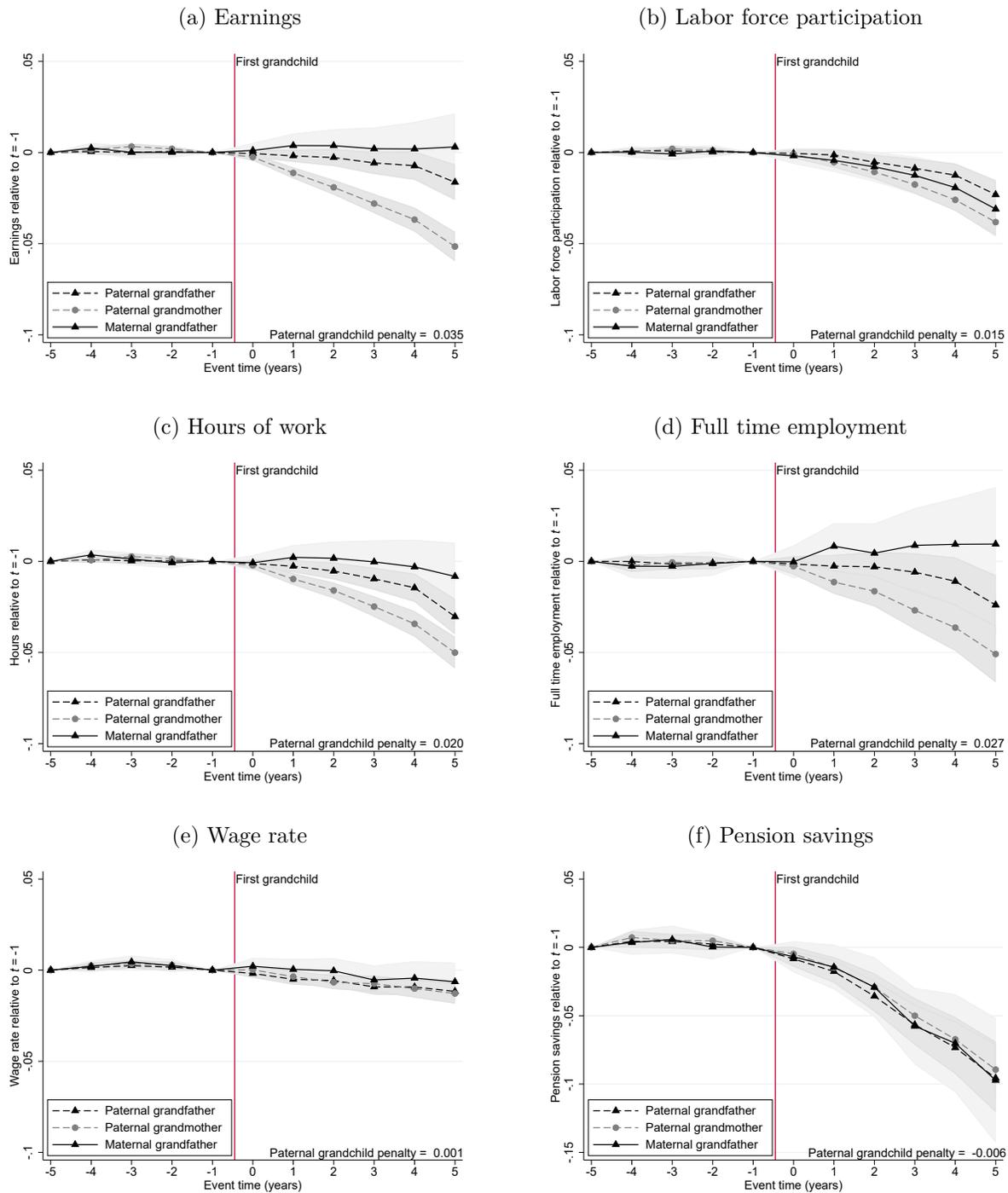
NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome, absent grandchildren (i.e., $P_t^{gp} \equiv \hat{\alpha}_t^{gp} / \mathbb{E}[\tilde{Y}_{ist}^{gp} | t]$) for grandfathers and grandmothers separately and for different outcomes. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985–2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The effects on wage rates are estimated conditional on participation. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

Figure A10: The Impact of Grandchildren on Commuting Time and Distance between Parents and Grandparents



NOTE— The figure shows event time coefficients estimated from Equation (1) for maternal and paternal grandfathers and grandmothers separately and for two different outcomes; log commuting time and log commuting distance. Each panel also reports a “grandchild penalty”, the percentage by which grandmothers are falling behind grandfathers due to grandchildren, as defined in Equation (2). The grandchild penalty is measured at event time 5. All of these statistics are estimated on a balanced sample of grandparents who have their first grandchild between 1985—2012 and who are observed in the data during the entire period between five years before and five years after the birth of their first grandchild. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

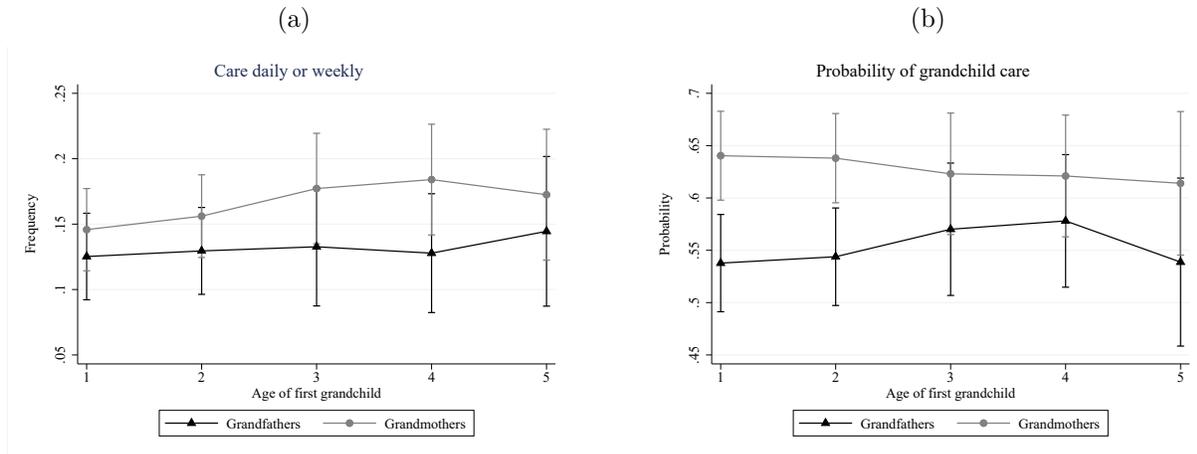
Figure A11: The Impact of Grandchildren in Families with no Maternal Grandmother



NOTE— The figure shows event time coefficients estimated from Equation (1) as a percentage of the counterfactual outcome absent grandchildren for maternal and paternal grandfathers and paternal grandmothers separately and for different outcomes. Each panel also reports a “paternal grandchild penalty”, the percentage by which paternal grandmothers are falling behind paternal grandfathers due to grandchildren, measured at event time 5. The wage effects are estimated conditional on participation. The pension savings effects are estimated on a sub-sample with grandchildren born after 2000. The shaded 95 percent confidence intervals are based on cluster robust standard errors.

A.5 Grandparents and child care time

Figure A12: Grandparents' child care time



NOTE— The figure shows the frequency on grandparents' care for children on a daily or weekly basis in panel (a) and the probability of grandparental care in panel (b). The bars indicate 95 percent confidence intervals from a t-test.

SOURCE— SHARE linked to register data.

Table A1: Summary Statistics of Time in Child Care Activities

	(1)	(2)	(3)
<i>Gender</i>	Grandmother	Grandfather	Difference
Child care time	11.54 (56.45)	5.838 (36.85)	5.701*** (4.22)
Observations	2688	2423	5111
<i>Maternal</i>	Grandmother	Grandfather	Difference
Child care time	12.19 (59.07)	10.71 (52.98)	1.484 (0.68)
Observations	1499	1189	2688
<i>Paternal</i>	Grandmother	Grandfather	Difference
Child care time	6.185 (35.63)	5.407 (38.31)	0.778 (0.52)
Observations	1342	1081	2423
<i>Grandchild born</i>	1985–2001	2002–2012	Difference
Child care time	7.907 (44.97)	10.39 (53.26)	-2.486* (-1.78)
Observations	3201	1910	5111
<i>Cohabitation</i>	Single	Couple	Difference
Child care time	11.19 (61.98)	8.629 (46.85)	2.557 (1.03)
Observations	413	4698	5111
<i>Grandparent born</i>	Before or in 1946	1947 or after	Difference
Child care time	9.014 (50.21)	8.637 (45.96)	0.377 (0.28)
Observations	2697	2414	5111
<i>Daycare</i>	Low	High	Difference
Child care time	8.172 (45.44)	9.656 (51.50)	-1.484 (-1.09)
Observations	2826	2285	5111
<i>Commute</i>	Less than 20 min	More than 20 min	Difference
Child care time	8.718 (47.44)	8.906 (48.73)	-0.188 (-0.14)
Observations	1915	3196	5111
<i>Time of week</i>	Week day	Weekend	Difference
Child care time	8.277 (47.79)	9.408 (48.71)	-1.132 (-0.84)
Observations	2585	2526	5111

NOTE— The table shows mean and standard deviation in parenthesis of time in child care activities measured in minutes per day for subgroups of the sample. The stars indicate significant t-statistics of the difference between columns (1) and (2), * 10%, ** 5%, and *** 1%.

SOURCE— Danish Time Use Surveys from 1987, 2001, and 2008.